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American Machinist

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And now for 1924

THE general plans for the contents of the "American Machinist" during 1924 provide for full quotas of articles dealing with the automotive and railroad-shop divisions of the industry and with management, engineering and manufacturing subjects.

As a part of the automotive group there is being prepared a series showing the practice in the best European plant.

Definite plans are laid for publishing constructive articles on railroad practice and equipment, continuing the campaign for modern equipment in railroad shops. There is ready a splendid array of practical engineering data including more of De Leeuw's articles "Modern Methods of Machine Tool Design" and a new series on estimating.

The design of gears is an important part of the machinery industry and will be fully covered.

While the preceding paragraphs constitute a promise they are only an indicator of the contents of the two 1924 volumes. The true-blue "American Machinist" will, as always, serve the industry from cover to cover.

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Giving You
A Record of Progress

LEADING FEATURES

of the

January 17th American Machinist

Review of New Equipment which has been described in the *American Machinist* in the preceding half-year; over 225 descriptions, with illustrations and specifications, of new machine tools, small tools, material-handling equipment, supplies, etc., grouped for the greatest convenience in reference.

Developments and Tendencies in Machine Tools.

Authoritative Views on General Industrial Conditions, showing trend of the Vital Economic Factors, of Prices of Materials, etc.

Programs of the Automotive, Electrical, and Railroad Industries.

Articles on Progress during 1923 in Gear Design and Production, in Steel Treating, in Welding, in Research, and in Standardization.

Employment and Immigration Situation analyzed and tendencies portrayed.

A Big Editorial Section of timely business and equipment news, *plus*—

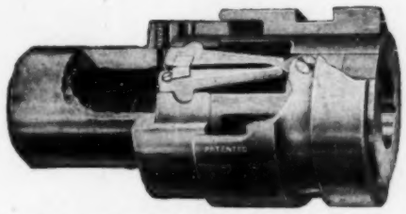
An Advertising Section that gives the most extensive range of equipment from which to fill your needs.

Equipment Review Number
American Machinist

THE JOHNSON FRICTION CLUTCH

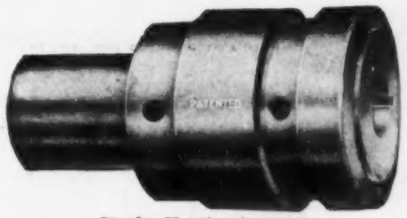
IS THE RELIABLE AND EFFICIENT

LINE-SHAFT CLUTCH



Single Clutch Showing Working Parts

Small, Compact, Powerful and Durable A Quality Product



Single Clutch—Exterior

Be Right, Thru 1924, by Using a Johnson Clutch

Drive your machinery direct from the line-shaft with a

Johnson Single Clutch

and do away with extra equipment when countershafts are used.

A saving in expense and upkeep worth considering.

Single Clutch With Steel Split Pulley Mounted on Hub

All machinery cannot be driven from line-shaft on account of the difference in speed and reverse motion desired.

The Johnson Double Clutch

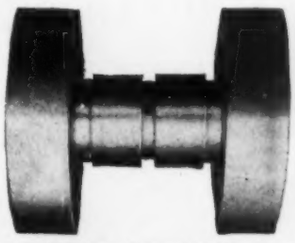
is designed to take care of these conditions.

Requires but little more space than a single clutch.

Our engineers will be glad to work out your clutch problems for you. Send for clutch information blank.

Double Clutch—Exterior

Write for Blue Catalog



Double Clutch With Pulleys on Hubs

THE CARLYLE JOHNSON MACHINE CO. MANCHESTER CONN

Here's a good

Perhaps you are looking for a lathe. If so, you want one that you can depend upon; one that will *last*!

A lathe that will *last* is the one that you should get. Such a machine represents an investment. It pays dividends in the form of continuous service long after other lathes of the same age have been discarded. It is the main reason today why the Lodge & Shipley Lathe stands out so conspicuously among the Master Machine Tools of Industry.

You have read what we say. Now read what somebody else recently wrote us:

> **"We have in our establishment a 14 in.x6 quick change Lodge & Shipley Lathe. The number of this lathe is 3032 and as far as our records show we have been operating this lathe continuously for about 17 years.**
>
> **With the exception of taking a shim out, the main bearings in the headstock were not touched in this period. Quite recently, however, through an accident the cone pulley was broken and we were compelled to make a new cone for the lathe.**
>
> **We gave the lathe a general overhauling and at the present time, in our estimation, it is good for ten years' more work."**

What do you think of that? After using it continuously for 17 years they are confident, that after a general overhauling the lathe will be good for ten years more.

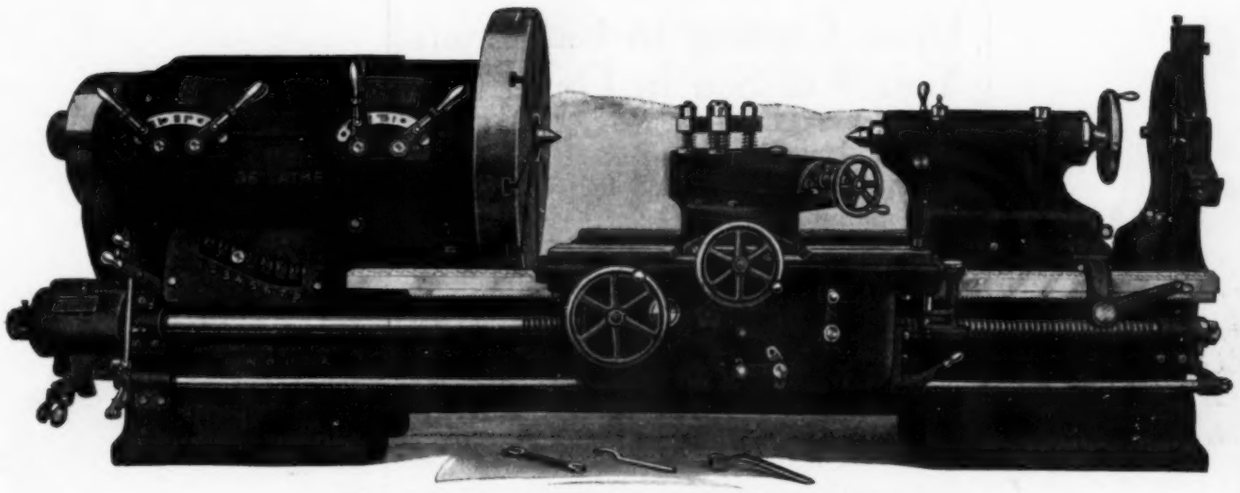
That's the kind of a lathe you want! If this customer had purchased a cheap lathe he undoubtedly would have replaced it three times by now *and yet, on top of all this he expects, and, no doubt, will get, ten years' additional service from the lathe he now has!*

Does it pay to buy a *good* lathe? We will let you answer that question yourself.

The Lodge & Shipley M

Cincinnati, Oh

reason!



36 in. Selective Head Lodge & Shipley Lathe
Made in sizes 12 in. to 48 in.

The Lodge & Shipley Lathe

is in a class by itself. Quite frequently we get letters telling us that Lodge & Shipley Lathes after 20 and 25 years' use have been overhauled and then turn out work as accurate as when they were new.

There is no secret about this. If you put value into a thing you get value out of it. This lathe can turn out accurate work over an unusually long period of time. IT LASTS! That is the reason for its popularity.

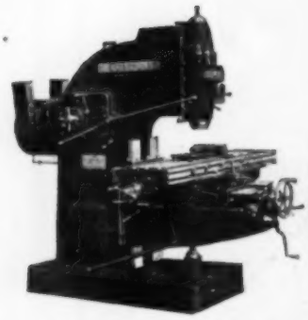
For the man who buys machinery as an investment, this lathe answers requirements to the letter. Let us show you why. It's all in the construction. Write for general loose-leaf catalogue. It goes into details. No obligation.

SEND FOR CATALOGUE TODAY.

Machine Tool Co.

Ohio

OUR WELCOME



Cincinnati No. 4 Vertical High Power Miller. One of 38 Types and Sizes of our Millers

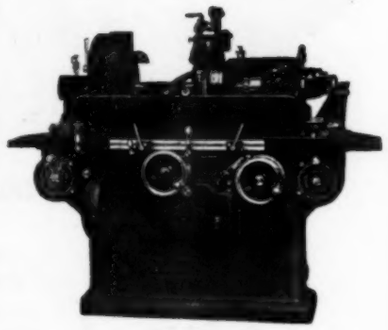
Upon Coming to Cincinnati You Will See In Our Plant

Modern Buildings
Machine Shop equipped for refinements in manufacturing.
Large Engineering and Design Dept.
Machine equipped Foundry with thoroughly tooled Pattern Shop.
Physical and Chemical Laboratories.
Tool Room with modern layout.
Centralized Tool Stores.
Precision Tools and Gauges.
Demonstration Room.
Complete line of our products in a running exhibit.
Operators' Instruction Sheets.

An Employees' Service Department
with
Modern Employment Methods

Careful Medical and Surgical Attendance for employees.
Sanitary and Safety Provisions.
Self-Service Dining Hall.
Co-operative Students of the University of Cincinnati at Work.

Cincinnati Grinder Company's line of Cylindrical Grinders; in the process of manufacture and in demonstration.



12 in. x 24 in. Plain Cincinnati Cylindrical Grinder

THE CINCINNATI MILLING MACHINE COMPANY

THE CINCINNATI GRINDER COMPANY

CINCINNATI GRINDERS

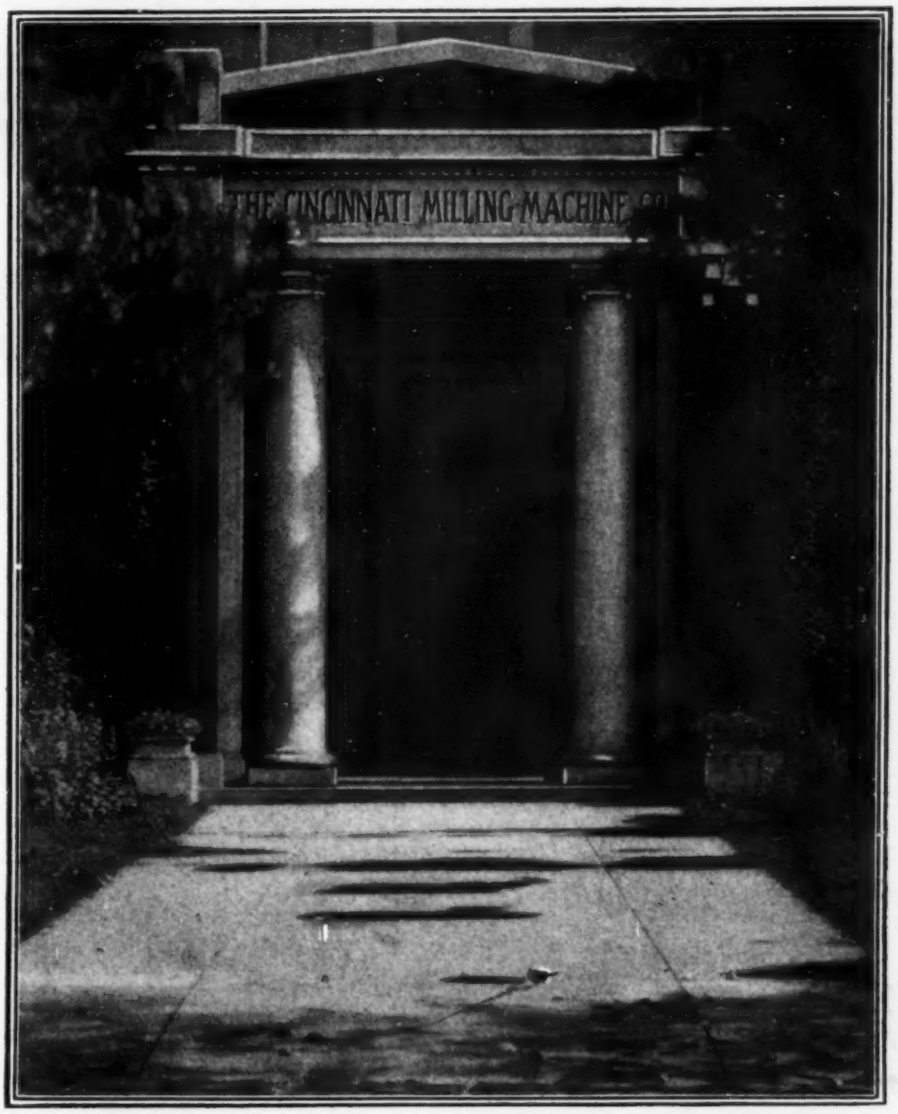
TO YOU IN 1924

Entering Our 40th Year

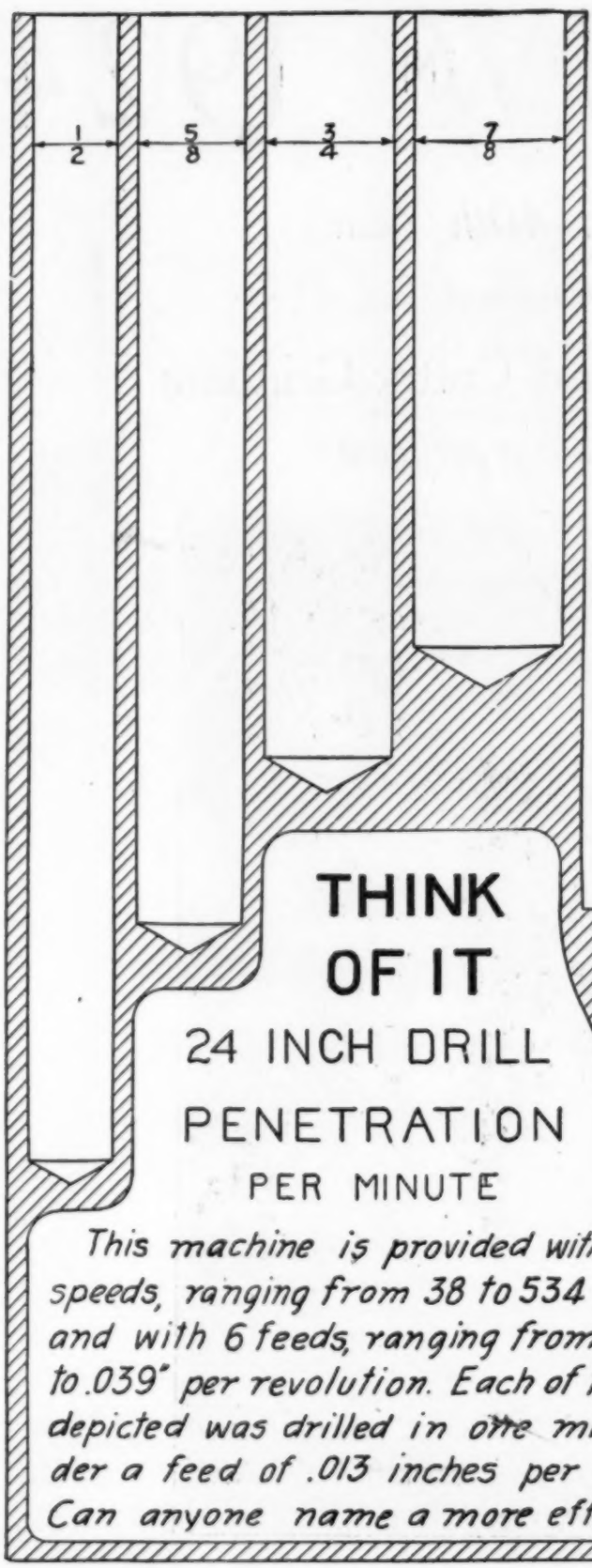
in the manufacture of

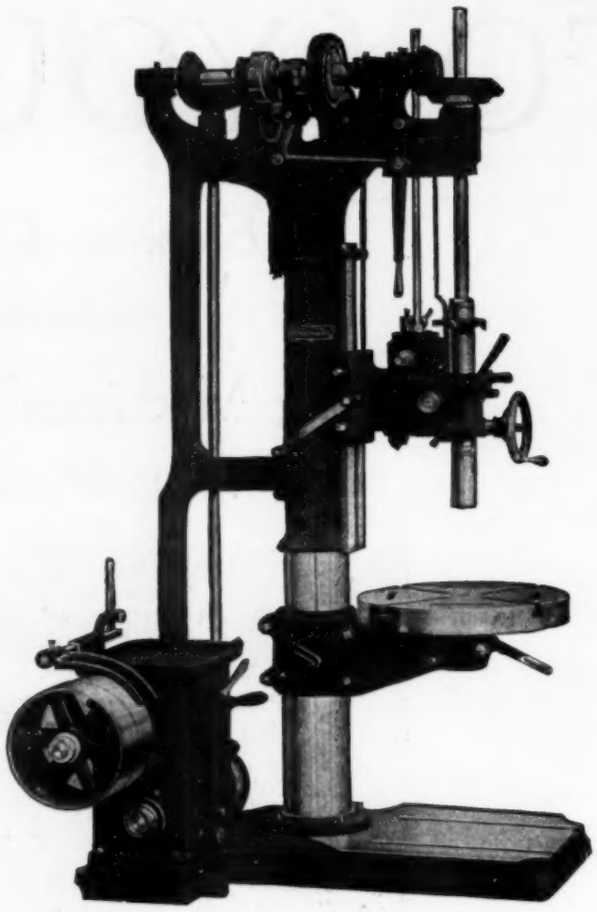
Milling Machines and Cutter Grinders

We invite you to visit our plant



CINCINNATI MILLERS





THINK OF IT

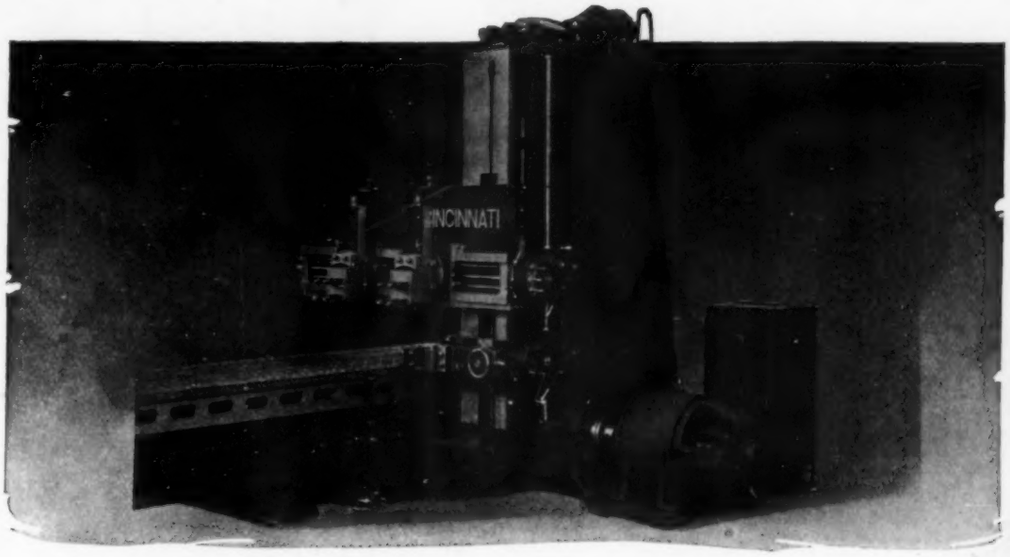
24 INCH DRILL PENETRATION PER MINUTE

This machine is provided with 16 speeds, ranging from 38 to 534 r.p.m, and with 6 feeds, ranging from .006" to .039" per revolution. Each of the holes depicted was drilled in one minute, under a feed of .013 inches per revolution. Can anyone name a more efficient tool?

The Cincinnati Bickford Tool Co.

Oakley, Cincinnati, Ohio, U. S. A.

SKF



Ball Bearings on Planers

Maintain Accuracy and Reduce Maintenance

UNLESS the bearings on vital parts of planers are capable of carrying heavy thrust loads without appreciable friction, wear takes place with the result that accurate work is impossible.

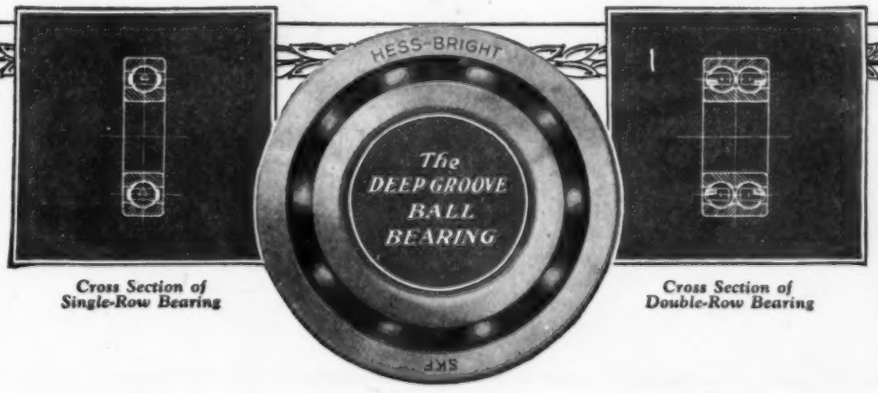
On this 60"x60"x16' open side planer Hess-Bright ball bearings on the down-feed screws and rail heads, on elevating screws for the knee and rail and on the rapid power traverse shaft and power traverse mechanism, insure maintained accuracy of product and smooth and efficient operation. And since quality ball bearings will last for the normal life of a machine and require no take-ups, a little lubricant applied during an off period is all the attention required.

Made of chrome alloy steel hardened uniformly throughout and held to close tolerances during manufacture Hess-Bright deep-groove ball bearings and thrust ball bearings have that endurance and maintained precision that is so important on machine tools of all kinds.

THE HESS-BRIGHT MANUFACTURING COMPANY

Supervised by SKF INDUSTRIES, INC., 165 Broadway, New York City

1078



Cross Section of Single-Row Bearing

Cross Section of Double-Row Bearing

BALL BEARINGS
The Highest Expression of the Bearing Principle

Machines for

THE Jones & Lamson Machine Company have announced certain improvements in the design of the *Hartness Flat Turret Lathe.* These improvements result in a more powerful and rigid machine, covering a wider range of work, but without loss of convenience or ease of handling.

So far as the details of these changes are concerned, they are not in any way radical or spectacular. The workman will feel as much at home with the new machine as with the old "J & L."

Briefly stated, the recent improvements permit us to offer a wider variety of Turret Lathes than ever before, covering a wider range of work; but at the same time this variety of machines has been standardized to the point where each is a simple variation of one carefully considered design.

The machines of this series will be designated as being of our *"Steel Head" Model.*

The "Steel Head" Model

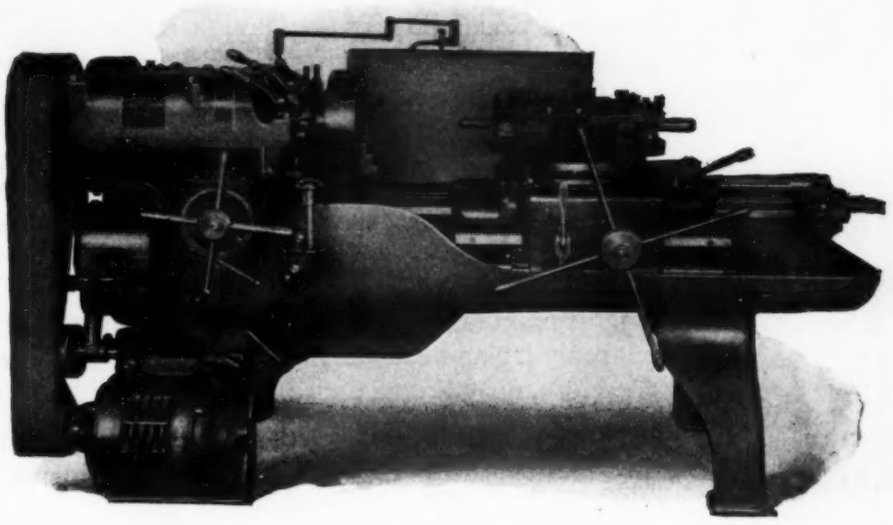
is made in seven styles and sizes covering ninety per cent of the average shop work.

2¼x24 in. Hartness Flat Turret Lathe for Bar Work.
3x36 in. Hartness Flat Turret Lathe for Bar Work.
12 in. Hartness Flat Turret Lathe for Chucking Work.
15 in. Hartness Flat Turret Lathe for Chucking Work.
17 in. Hartness Flat Turret Lathe for Chucking Work.
Double Spindle Hartness Flat Turret Lathe.
Double Spindle Production Lathe.

In general the machines of this model provide a much more powerful drive to the spindle than ever before attained, and an increase in strength of feed as well.

Particular attention has been given to durability by the use of hardened steel gears, multiple disc clutches and ball bearings on all driving shafts.

r Chucking Work



15-inch Capacity

Hartness Flat Turret Lathe

with Chucking Outfit

"Steel Head" Model

This is the same machine as the 3x36 in. bar machine, the only difference being in the equipment.

This machine and its equipment offer the most approved means for performing chucking operations on 90% of the work to be found in the ordinary machine shop. The power of the drive, the rigidity of the cross sliding head and flat turret, the accuracy of the stops, the lightness and convenience of manipulation—all combine to give that conjunction of output and accuracy which is the ultimate aim of the progressive shop man.

The increased power and durability of the headstock mechanism will be appreciated.

Send for the set of Bulletins covering the "steel head" line.
You will surely find the machine you have been looking for.

Jones & Lamson Machine Co.
SPRINGFIELD, VT., U. S. A.

"Out with the old, a

The quotation has not lost its real meaning in the slight changes we have made in it in order to apply it to our case.

Foreman Goodfellow, of the Davidson Pump Co., Brooklyn, N.Y. caused us to make the alteration when he expressed his opinion of *American Triple-Purpose Radials.*

He said:
"We have discarded our old radials to make room for *Americans* because one *American replaces two ordinary radials.*"

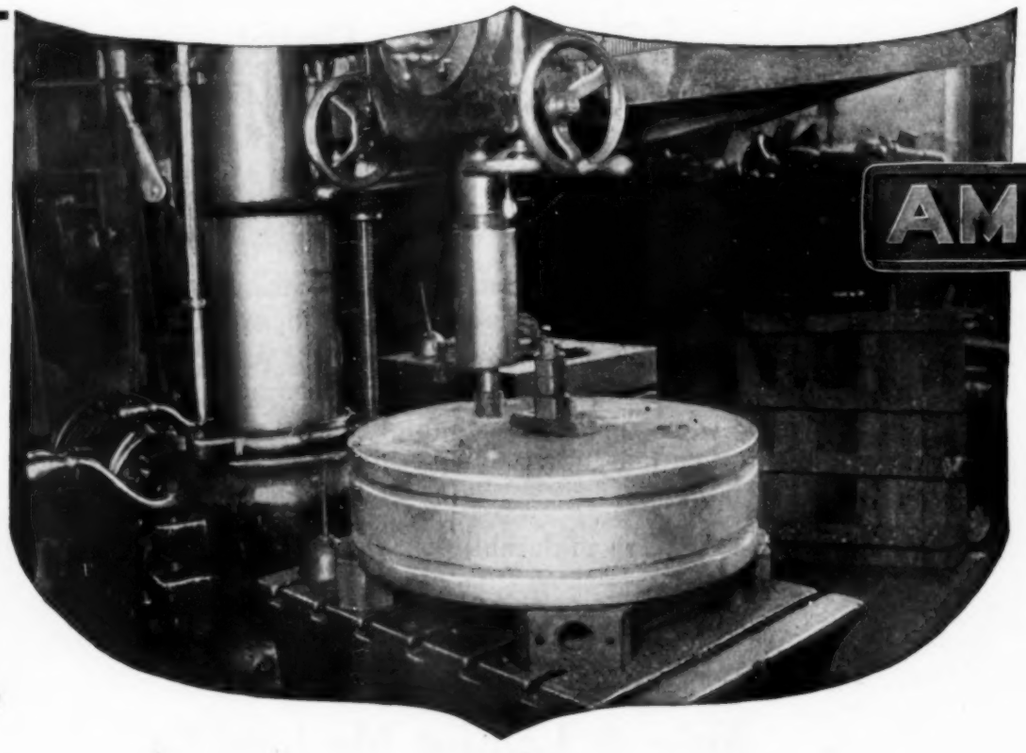
There are sound reasons for his statement.

Engine manufacture is particularly dependent upon the precision, adaptability and economy of the machines used in drilling. It is, therefore, not hard to understand the predominance of *American Triple-Purpose Radial Drills.*

In practically all the great machinery industries—automotive,

Triple-Purpose Radial Drills

"Do it on an



The American Tool Works Co

nd in with the new"

railroad shops, pumps, textile machinery, printing machinery, electrical equipment, etc.—you will find that the leaders "do it on an *American*."

One time-proven factor for this supremacy is the internal gear drive for boring and tapping. The smooth, steady action of the spindle is due to the high gear ratio and ample proportions of gears and shafts. Chatter and vibration are practically eliminated.

The *American Triple-Purpose Radial* shown in this space is tapping 2-inch plug holes in cast-iron Steam Pistons. Nothing unusual about this job excepting the speed and precision with which the *American* goes about it.

It will pay you to consider the application of *American Radials* to your work. If interested, our Engineers will furnish convincing facts.

Lathes
Planers
Shapers
Radials

a*American*"

Company, Cincinnati, Ohio, U.S.A.

—for the *same*
reason you
buy safety razors
and Eversharp pencils—

Save the holder—
use the refill

Why not install in your shop, the economy of time and convenience you practice in your daily life?

Safety razors and mechanical pencils—when they get dull or break—in goes a new blade or whole lead—and you go whistling on your way.

Think of the hundreds of half-used solid tools—tongs twisted, teeth broken, etc.—that lie in your tool cribs. Dollars in the discard that should be dollars in the bank account.

Murchey Threading Tools—55 sizes of Self-Opening Dies and 46 sizes of Collapsible Taps afford a complete standardized Threading Service to a progressive shop.

The *economy* of mild steel bodies with High Speed Steel blades that last five times as long as solid tools, is overshadowed by the fact that they will stand twice the speed.

Tools, chasers or catalog upon receipt of a postal.

Murchey Machine & Tool Co.
953 Porter Street, Detroit, Mich., U. S. A.

Cleveland Office, 6523 Euclid Avenue; Pittsburgh Representatives, Laughlin & Barney, Union Trust Bldg.; Chicago Representatives, R. E. Ellis Engineering Co., 621 Washington Blvd.; Los Angeles Representatives, Smith-Booth-Usher Co., 228 Central Ave.; San Francisco, Smith-Booth-Usher Co., 50-60 Fremont St.; Coats Machine Tool Company, 14 Palmer Street, Westminster, London, S. W., England; Fenwick Freres & Company, 8 Rue de Rocroy, Paris.

MURCHEY

Collapsible Taps and Self-Opening Die-Heads

It is discouraging to see in many up-to-date shops, old worn out internal grinding machines trying to pound out a modern day's work.

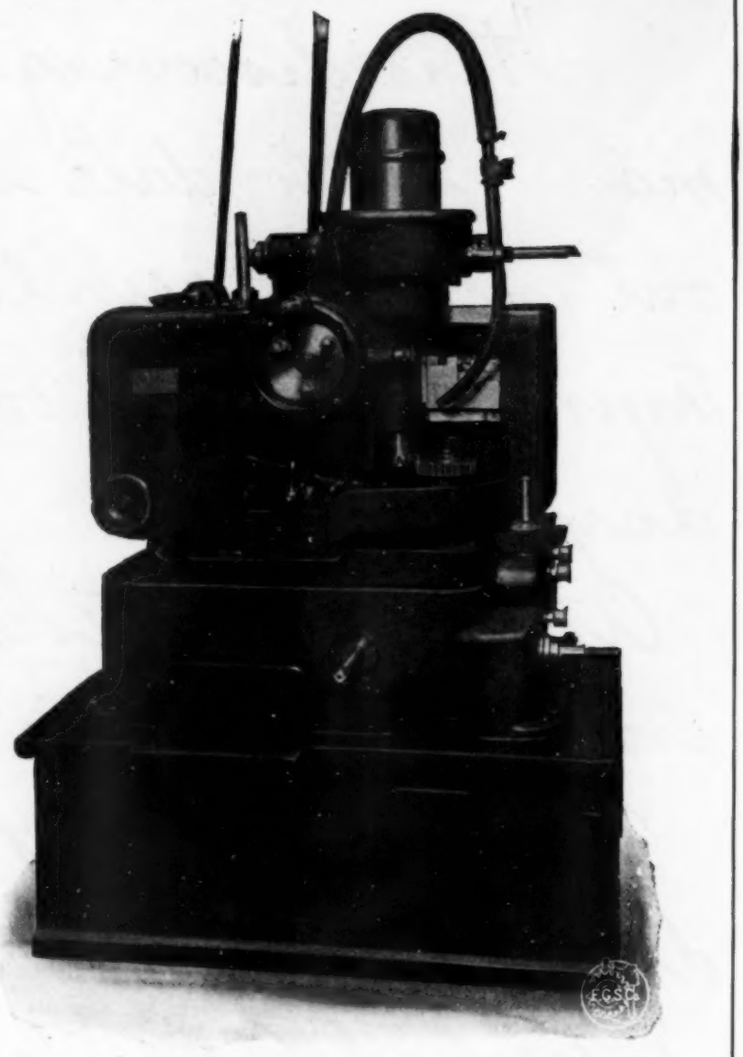
At one time they were good enough — but so were horses.

To-day when it comes to production — The Heald Hydraulic Internal Grinder is to the manufacturer what the air-plane is to the mail service

The Heald Machine Co.
Worcester Mass.

GEAR SHAPERS AND GEAR SHAPER CUTTERS

It Pays to Investigate First



Because of the satisfaction derived from seeing what you are getting, and the further possibility of weighing values.

Because investigation is your best assurance of obtaining satisfactory results.

You may not be in immediate need of a new gear cutting machine, and if that is the case, now is your best time to investigate the possibilities of the new High-speed Gear Shaper—a hurried decision is generally unprofitable.

Before you purchase gear cutting equipment, ask users of the Gear Shaper what they think of it—they are our best advertisement.

Start your investigation by sending for a copy of our booklet "A New Development in Gear Cutting."

A copy is yours for the asking

THE FELLOWS GEAR SHAPER COMPANY

Makers of Gear Cutting Machinery and Cutters for the Past Quarter of a Century

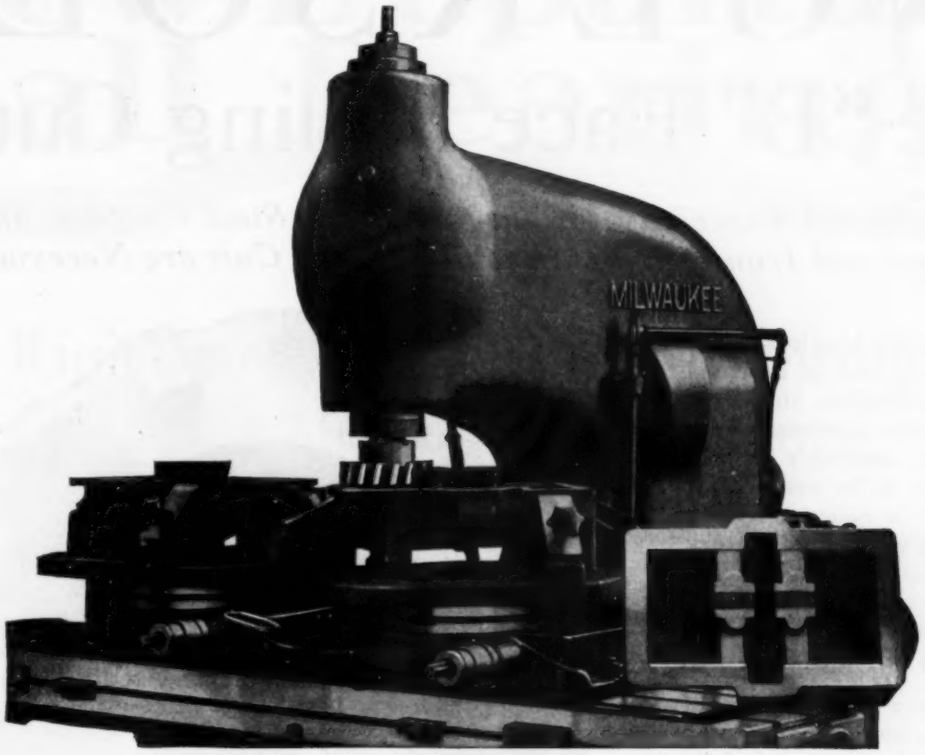
Springfield, Vermont, U. S. A.

Foreign Agents: Alfred Herbert, Ltd., Coventry, England; Societe Anonyme Alfred Herbert, Paris, France; Societa Anonima Italiana Alfred Herbert, Milan, Italy; Alfred Herbert, Ltd., Yokohama, Japan; Societe Anonyme Belge Alfred Herbert, Brussels, Belgium; Alfred Herbert (India) Ltd., Head Office, Calcutta, India; Bohm & Bormann, Berlin, Germany.

Pacific Coast Representatives: Harron, Rickard & McCone, San Francisco and Los Angeles, California; Nevada; Arizona.

THREAD GENERATORS AND THREAD GENERATING CUTTERS

If it can be milled KEARNEY & TRECKER MILWAUKEE MILLING MACHINES *– mill it faster!*



Double Up!

THE quickest way to increase production is to double up the work. That is what PRODUCTION SERVICE did on this job—using two rotary tables instead of one.

Here was a case where it was impossible to use a large face mill and make one pass across the top of the casting. The raised bearing in the center prevented this.

We overcame that obstacle by using a rotary table and milling *around* it. Then, "doubled up" by adding a second rotary table. This permits the operator to load one casting while the other is being milled.

We will "double up" YOUR job if you will give us the opportunity.

KEARNEY & TRECKER MILWAUKEE MILLING MACHINES

KEARNEY & TRECKER
CORPORATION
MILWAUKEE, WIS.

Please send PRODUCTION SERVICE Data Sheets and Illustrated Booklet to:

NAME .....

FIRM NAME .....

FIRM ADDRESS .....

27

INGERSOLL

Type "B" Face Milling Cutters

Designed Especially for the Milling of Steel Forgings and Steel and Iron Castings in which Heavy Cuts are Necessary

The type "B" is the heaviest of the Ingersoll Cutters and is designed for milling steel forgings, steel castings, or large iron castings where heavy cuts are necessary or the amount of stock to be removed is irregular. It is a general service cutter especially well suited to work such as is ordinarily found in jobbing shops. It is capable of removing stock to the depth of ½ of an inch at one pass of the table.

The housing is a steel forging of especially heavy section, carbonized and hardened. Each tooth is held independently in its slot by means of a clamp and heavy machine screw. They are of alternate widths, being ¾ inch by 1¼ inches, and ¾ inch square. This design and construction gives the Ingersoll Type "B" Cutters a capacity for heavy milling work which places it in a class entirely by itself.

The Type "B" Cutter is driven by a standard radial key 1 inch wide by ½ inch deep.

We recommend the type "R" or "S" Cutters for the lighter work where the cut is broken up into narrow sections.

Any of the following bulletins will be mailed to you upon request:

No. 39—"Ingersoll Continuous Milling Machines".
No. 40—"Ingersoll Installations of Milling Equipment".
No. 41—"Ingersoll Drum Type Continuous Milling Machines".
No. 42—"Ingersoll Railroad Rod Milling Equipment".
No. 43—"Ingersoll Face Miling Cutter Grinders".
No. 44—"Ingersoll Inserted Tooth Milling Cutters".

Ingersoll Type "B" Face Milling Cutters

The Ingersoll Milling Machine Co.

Milling Machines and Their Equipment

Detroit: David Whitney Bldg. ROCKFORD, ILL. 50 Church St., New York

New Departure Ball Bearings

Rigidity in Any Bearing Mounting Implies Unchanging Support

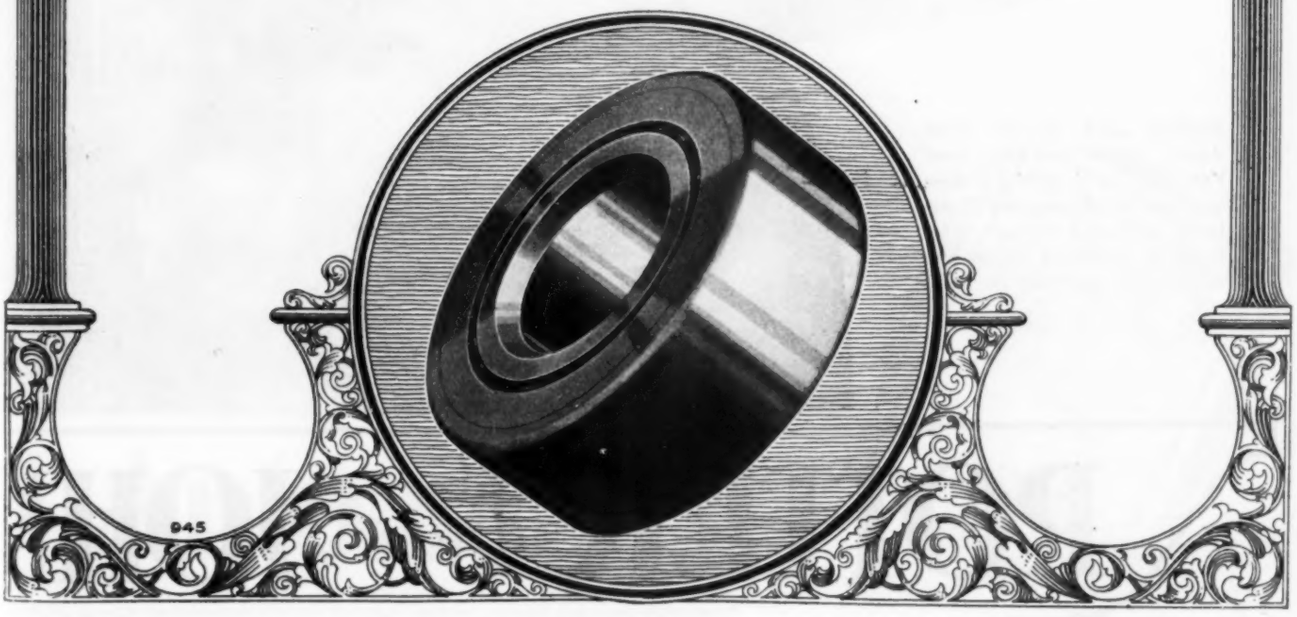
EXTREME rigidity is an essential in all gear mountings. The reason for this is best stated by an authority who says: "A correct position once attained should never be altered. Gears do not require adjustment to compensate for wear."

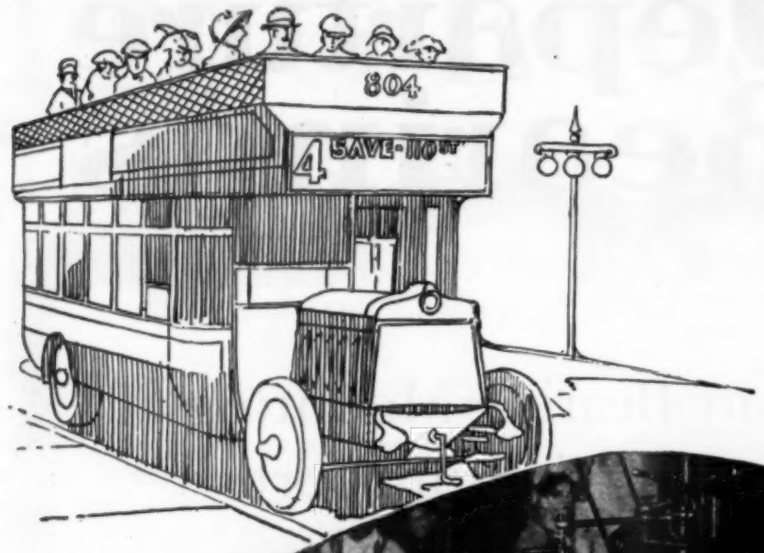
It follows "as night the day" that in order to maintain this correct gear adjustment rigidly and permanently, you *must* use a bearing which does not wear and let down on that adjustment.

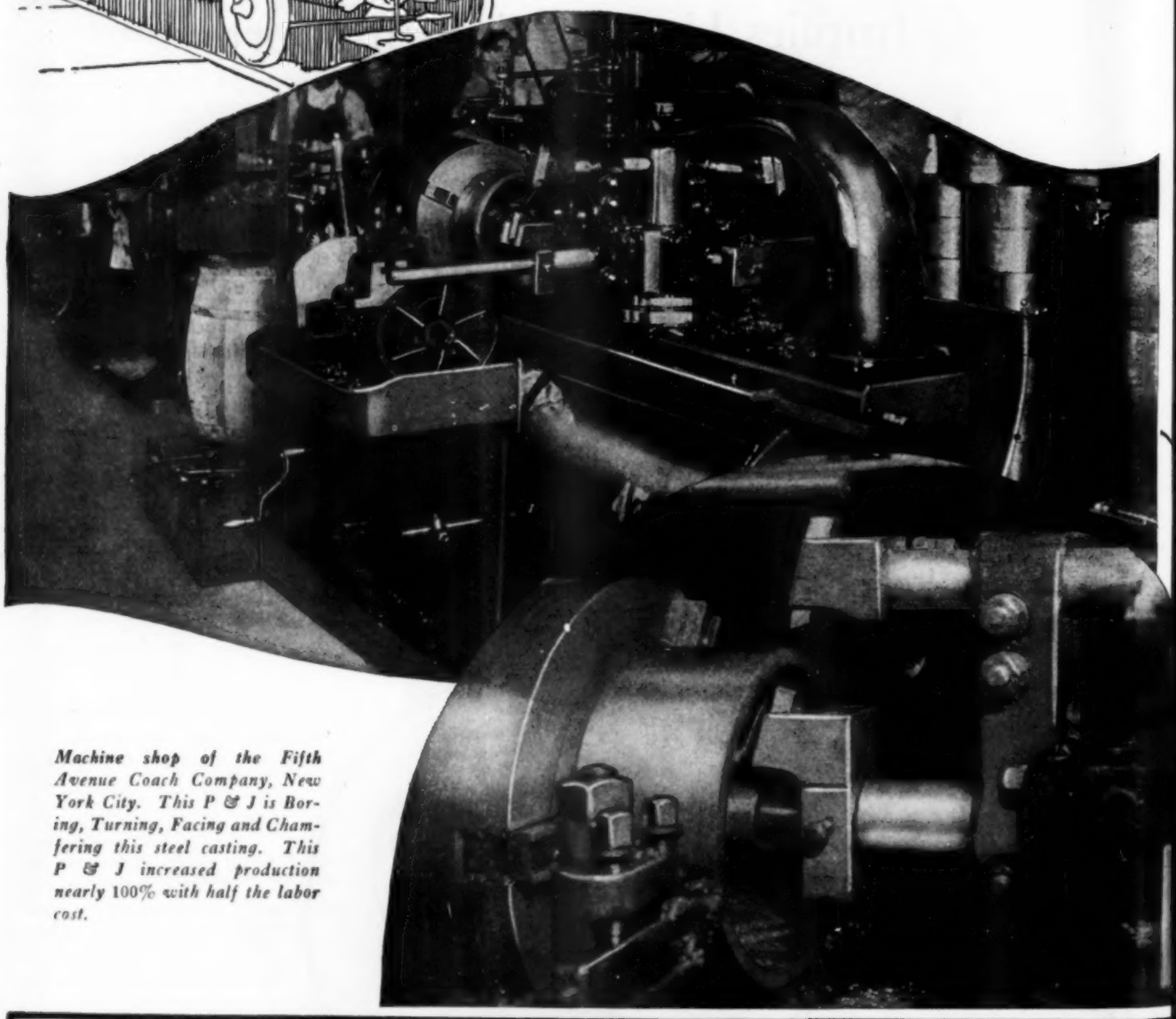
If you support your mounting with a type bearing that, because of mechanical principle, wears sufficiently to require adjustment at intervals, the position of the gears it supports is constantly being let down, taken up, let down, taken up—thereby giving anything but a rigid mounting.

For gear mountings as well as other positions, New Departure ball bearings are ideal, because they locate the parts they support permanently. No adjustment is necessary or possible. They outlast the mechanism itself.

THE NEW DEPARTURE MANUFACTURING COMPANY
Detroit *Bristol, Conn.* Chicago







Machine shop of the Fifth Avenue Coach Company, New York City. This P & J is Boring, Turning, Facing and Chamfering this steel casting. This P & J increased production nearly 100% with half the labor cost.

POTTER & JOHN

The Fifth Avenue Coach Company finds that—"it pays to replace" — with P & J Automatics

One P & J replaces two Turret Lathes with nearly a 100% increase in output

"Keep 'em running" is the watchword at the shops of the Fifth Avenue Coach Co.—*and they do.*

Back of their big fleet of double-decked sight-seeing buses is an unusually efficient Machine Shop, a corner of which shows a new Potter & Johnston Automatic. This machine was installed two months ago, for the purpose of machining these duplex brake drums, tough steel castings.
Results—

—replaced two modern Turret Lathes.
—occupies one-half former floor space.
—halved the labor cost.
—INCREASED PRODUCTION NEARLY 100%

Small wonder they are enthusiastic about P & Jaccomplishments. But they are likewise deserving of much credit for the spirit of progressiveness that inspired them to analyze all their machining methods, in the light of progress made in modern Machine Tool development.

Far-seeing Management, everywhere, is convinced that "it pays to replace" and to do it AUTOMATICALLY where possible. Naturally they turn to Potter & Johnston.

Our Engineering department will gladly give you an estimate from your prints or layouts—there's not the slightest obligation—you'll understand better what real P & J economy means.

Potter & Johnston, Pawtucket, R. I.

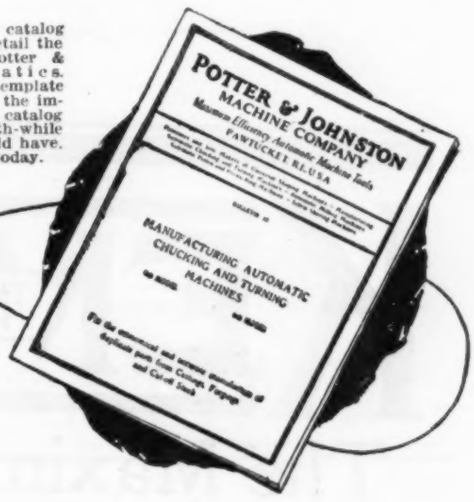
DOMESTIC OFFICES: New York Office: Hudson Terminal Bldg., 50 Church St., Walter H. Foster, Manager. Detroit Office: The Potter & Johnston Agency Co., 535 Bates St. Chicago Office: 3057 Eastwood Ave., Leslie J. Orr, Manager. Pacific Coast Office: Wesley Terrace Hotel, Los Angeles, Cal., Charles H. Shaw, Manager.

CANADIAN REPRESENTATIVES: Arthur Jackson, 177 Roxboro St. E., Toronto, Can.

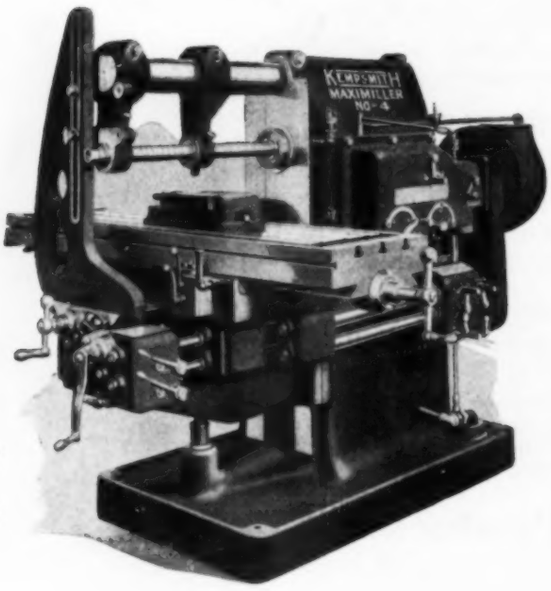
FOREIGN REPRESENTATIVES: L. J. Colomb, 68 Avenue de la Grande Armee, Paris, France. Representative for France, Belgium, Switzerland, Spain and Portugal. Charles Churchill & Co., Ltd., London, Birmingham, Manchester and Newcastle-on-Tyne, England and Glasgow, Scotland. Ercole Vaghi, Corso Porta Nuova, 34 Milan, Italy. Rylander & Asplund, Stockholm, Sweden. Yamatake Company, No. 1 Yurakucho, Ichome, Kojimachiku, Tokyo, Japan.

N Automatics

Let us mail you this catalog which illustrates in detail the recent models of Potter & Johnston Automatics. Whether you contemplate purchasing or not, in the immediate future, this catalog brings timely, worth-while information you should have. Request your copy, today.

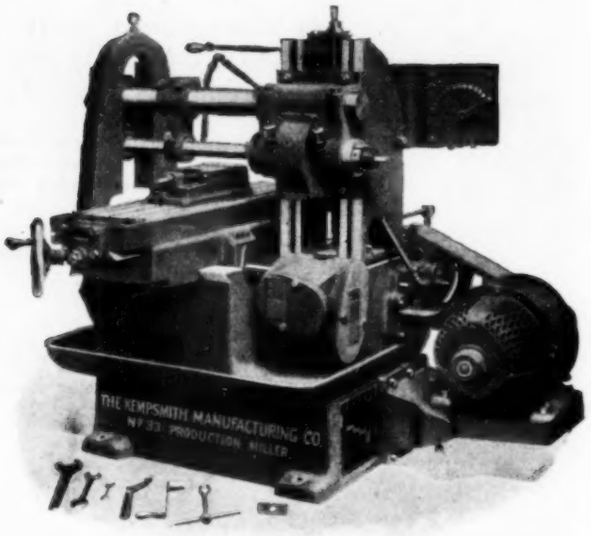


FOR genuine ability to turn out the work for which it is intended, for power to take repeated heavy cuts, and rigidity to withstand vibration, Kempsmith milling machines, both types, are universally favorably known. The manual control of a Kempsmith machine is well thought out and conveniently arranged. The man of average intelligence will quickly learn and obtain superior results from the machine.



The No. 4 Maximiller, a machine of greater power, greater productive value and greater economy of labor.

The No. 33 Production Miller, a machine built to produce a high volume of duplicate parts.



KEMPSMITH

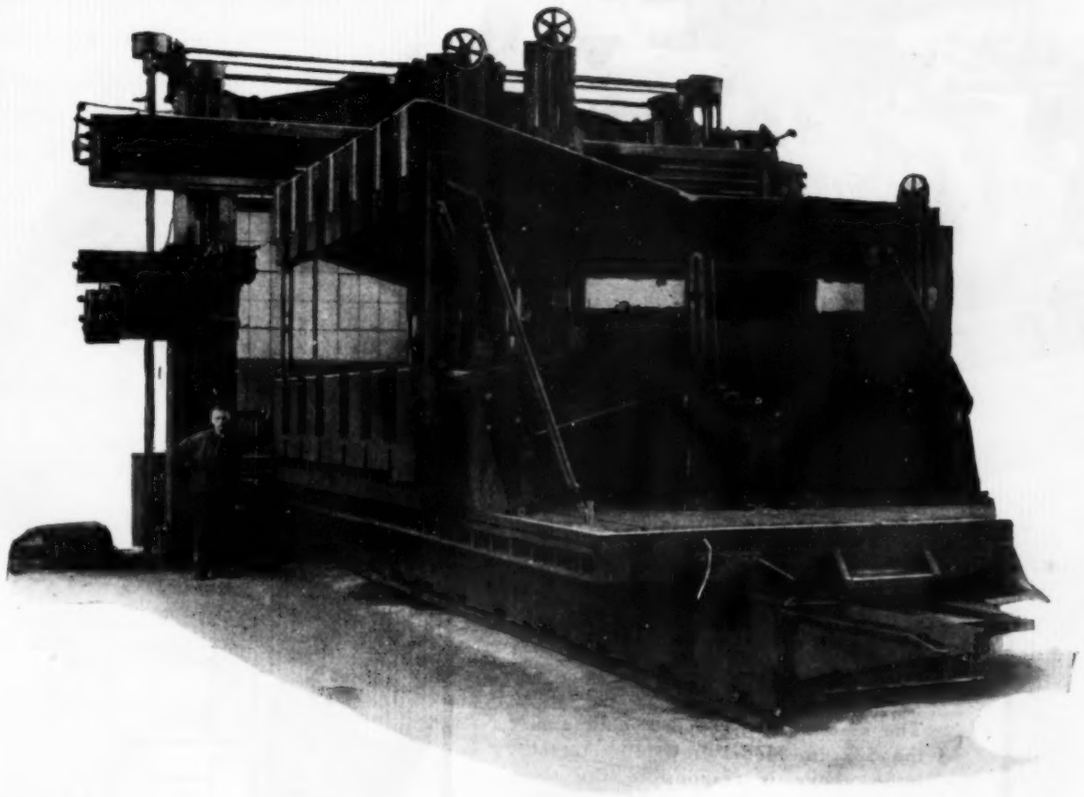
THE KEMPSMITH MFG. CO
MILWAUKEE U.S.A.

The Maximum in Milling Machines

CONSOLIDATED MACHINE TOOLS

BETTS

Heavy Duty Planers



The illustration shows a large Betts Heavy Duty Planer at the plant of McIntosh Seymour Corporation, planing Diesel Engine housings. This machine takes 15 feet between upright, 10 feet under the tool and has a 36-foot planing length.

When buying your next planer investigate the records of these machines in actual service—they will give satisfactory service continuously for years and without costly repairs.

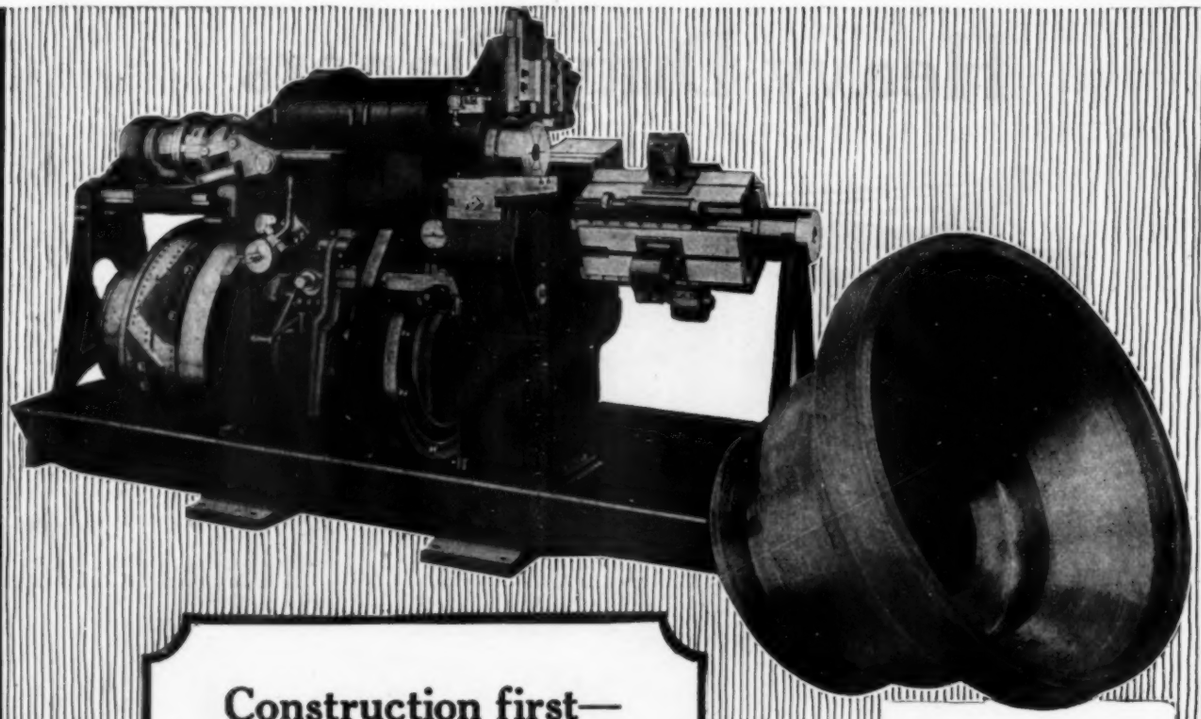
Write us for prices on any of these tools

BETTS	COLBURN	HILLES & JONES	MODERN	NEWTON
Engine Lathes	Drill Presses	Punches and Shears	Plain Grinders	Cold Saws
Boring Mills	Special Drills	Bending Rolls	Universal Grinders	Crank Planers
Planers	H. D. Boring Mills	Plate Planers	Magic Chucks	Milling Machines
Slotters	Standard Boring Mills	Flanging Clamps	S. O. Die Heads	Rod Borers
Axle Lathes, Etc.	Rod Boring Machines, Etc.	Straightening Rolls, Etc.	Threading Machines, Etc.	Cylinder Borers, Etc.

CONSOLIDATED MACHINE TOOL CORPORATION OF AMERICA

402 BLOSSOM ROAD **ROCHESTER, N. Y.**

Model L Gridley Single Spindle

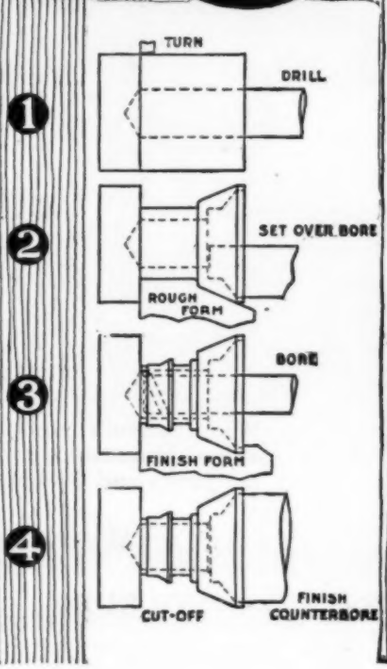


Construction first—your costs depend on it.

The kind of tool support you see in the 5¼ in. Model L Gridley turret lathe above is responsible for the heavy forming, boring and counterboring operations shown on the diagram of this steel job.

And the standardization of tools for both roughing and fine finishing enables you to change from one job to another on the shorter runs without excessive expense of equipment or time.

After all it's the quantity per hour that measures the cort per piece. It costs you nothing to find out how many you can get on Gridleys. Capacities 2¼ in. to 5¼ in.



The National Acme Company

Windsor, Vt. Cleveland, O.

New York, Boston, Buffalo, Chicago, Detroit, Los Angeles

The Purpose of a Good Cutter

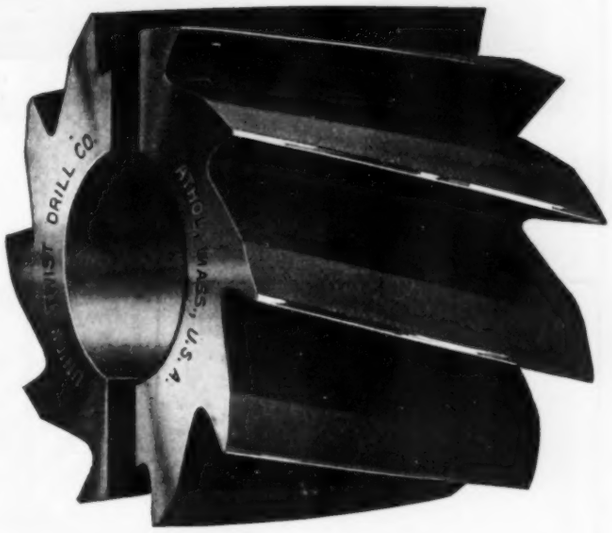
Union High Power Cutters were developed to keep on the job—not to furnish a position for a tool grinder.

The cutting teeth are designed for maximum strength and the care used in material selection and final heat treating assure an unusual service life.

Union Cutters cost less in the end, as is being daily proven by production charts.

Let us give you reasons for using

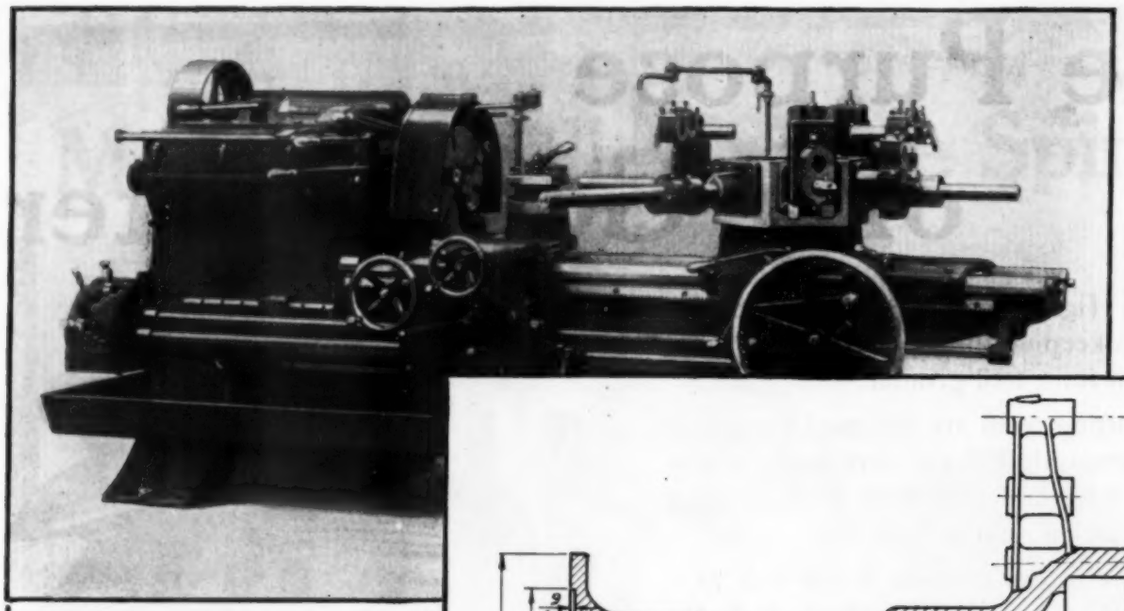
UNION
High Power Cutters

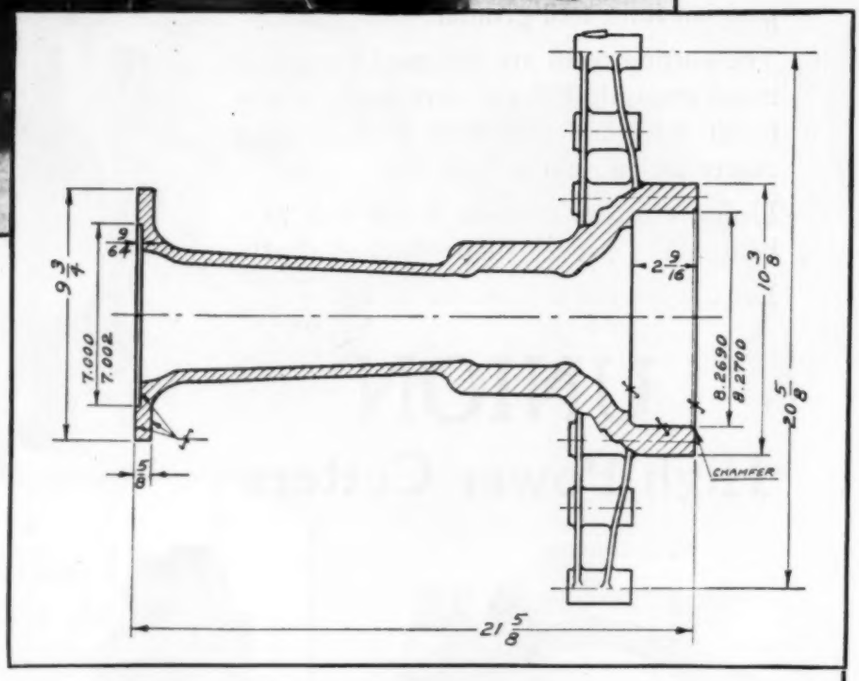


UNION TWIST DRILL CO.
Drill, Reamer and Cutter Makers
ATHOL MASS. USA

DOMESTIC AGENTS: Buffalo, Root, Neal & Co.; Cincinnati, V. N. Devou Supply Co.; Cleveland, White Tool & Supply Co.; Detroit, The Boyer-Campbell Co.; Evansville, Evansville Supply Co.; Grand Rapids, McMullen Machinery Co.; Houston, Brazelton, Wessendorff & Nelms; Indianapolis, Vonnegut Machinery Co.; Minneapolis, F. E. Satterlee Co.; Milwaukee, The Philip Gross Hardware; New Haven, The Page, Steele & Flagg Co.; New Orleans, Oliver H. Van Horn, Inc. (Cutters); Passaic, New Jersey Engineering & Supply Co.; Philadelphia, E. M. Hanson & Co.; Pittsburgh, Somers, Fitler & Todd Co.; Rochester, Homer Strong; San Francisco, Fred Ward & Son; Springfield, W. J. Foss Company; St. Louis, St. Louis Machinists Supply Co.; Syracuse, Syracuse Supply Co.; Toledo, National Supply Co.; Trenton, N. J., Warren Balderston & Co.; Worcester, Brierly-Lombard Co.; Wayne Hardware Co., Fort Wayne, Ind. FOREIGN AGENTS: Australia, Bevan & Edwards, Ltd., Melbourne; Australia, Engineering Supply Co. of Australia, Ltd., Brisbane; Belgium, Charles L. Demoor, Brussels; China, Anderson, Meyer, Shanghai; Denmark, V. Lowener, Copenhagen; England, Markt & Co., London; France, Societe Aux Forges de Vulcain, Paris; Greece, A. M. Papasideris & Co.; Italy, Chas. Civita, Milano; Norway, V. Lowener, Christiania; Spain, Hijo de Miguel Mateu, Barcelona; Sweden, V. Lowener, Stockholm.

Tools you buy again





Both ends completed in one chucking

Big Saving in an Up-to-Date Motor Truck Plant

A rear axle tube for a Motor Truck required 28 minutes to finish. Because additional equipment was necessary to finish a new and larger tube, the manufacturer investigated other methods than what he was using.

He found that Warner & Swasey 3-A Turret Lathe could do the work on this larger tube in **10½ minutes**. A big saving over the **28 minute** method.

The Warner & Swasey Company

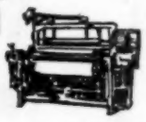
CLEVELAND, OHIO, U. S. A.

NEW YORK: Singer Building
CHICAGO: 618-622 Washington Boulevard
MILWAUKEE: 1143 Wells Building
BOSTON: Oliver Building
BUFFALO: Iroquois Building
DETROIT: 5928 Second Boulevard
DAYTON: 518 Mutual Home Building

May all the threads you cut in 1924 be clean and true

S.W. CARD MFG. CO.
DIVISION OF UNION TWIST DRILL CO.
MANSFIELD, MASSACHUSETTS. U.S.A.

We'll Fight Friction for you *Everywhere*

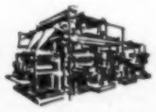


Textile Machinery | Elevators

Woodworking Machinery | Rail Cars

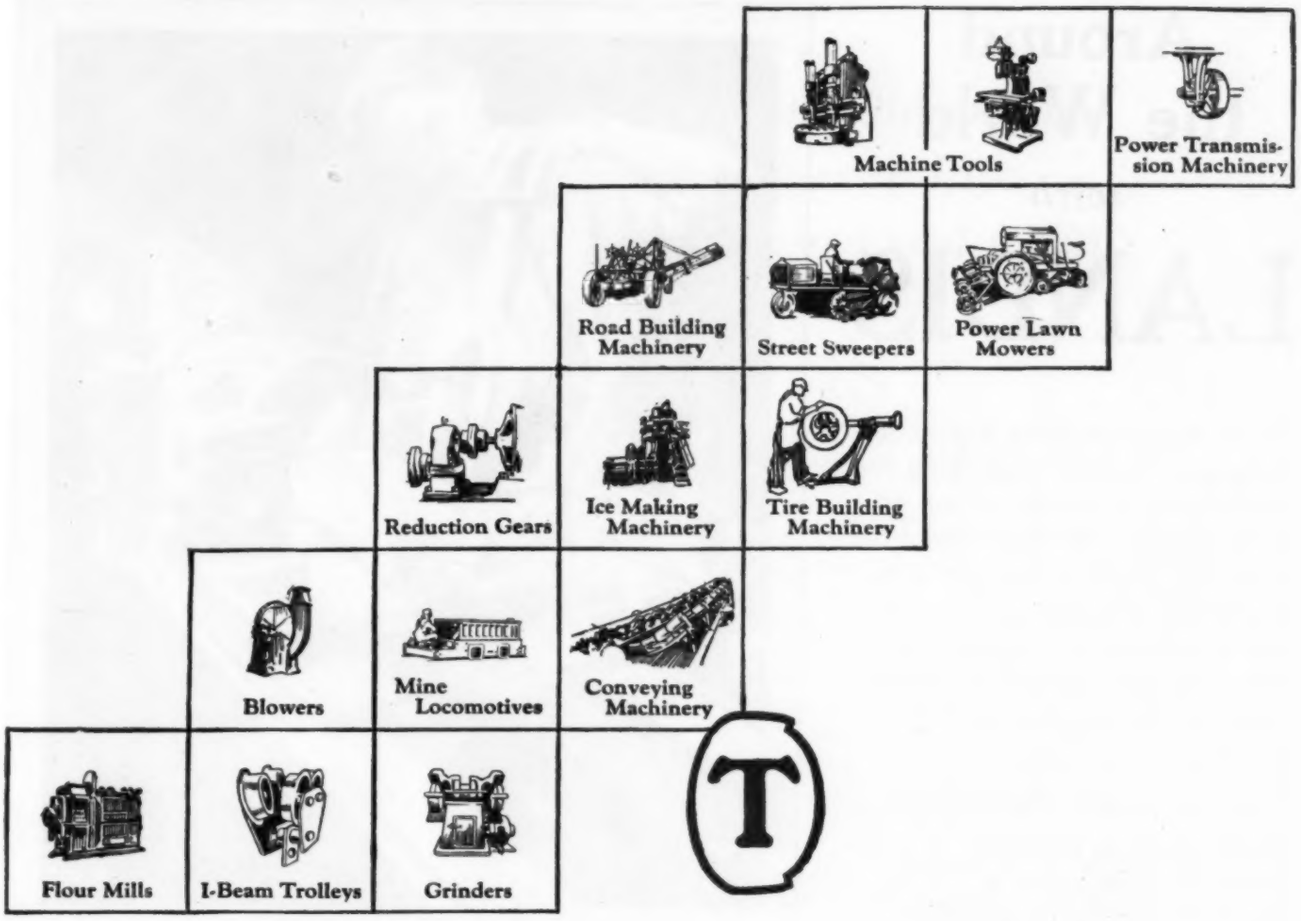
Railway Signal Devices | Mine Cars | Clay Machinery

Pumping Machinery | Coffee Grinders | Electric Motors



Paper Machinery | Printing Presses | Electric Hoists

© 1923, By The T R B Co, Canton.



Timken Universality

Emphasizing the wide adaptability of Timken Tapered Roller Bearings to all industry, illustrations are shown herewith of some of the installations in which Timken Bearing superior efficiency is being demonstrated.

That Timken dominancy, so pronounced in the automotive world, is assured in the world of general industry, is clearly indicated by the ever-increasing number of manufacturers who are turning to Timken Bearings almost daily for the improvement and refinement of their products.

In general industry, as in the automotive industry, Timken Bearings mean not only improved products but always more economical operation of those Timken-equipped products.

This is true because in addition to their anti-frictional qualities; in addition to the ability of Timken Tapered Roller Bearings to carry radial loads, *and* thrust loads, *and* resultant loads, uniformly and simultaneously; in addition to the fact that tapered roller bearings carry more load per unit of space required than any other type of bearing; in addition to all these characteristics Timken Tapered Roller Bearings are adjustable for that wear which *must* follow motion. Just a simple turn of a nut and your Timkens function as when new.

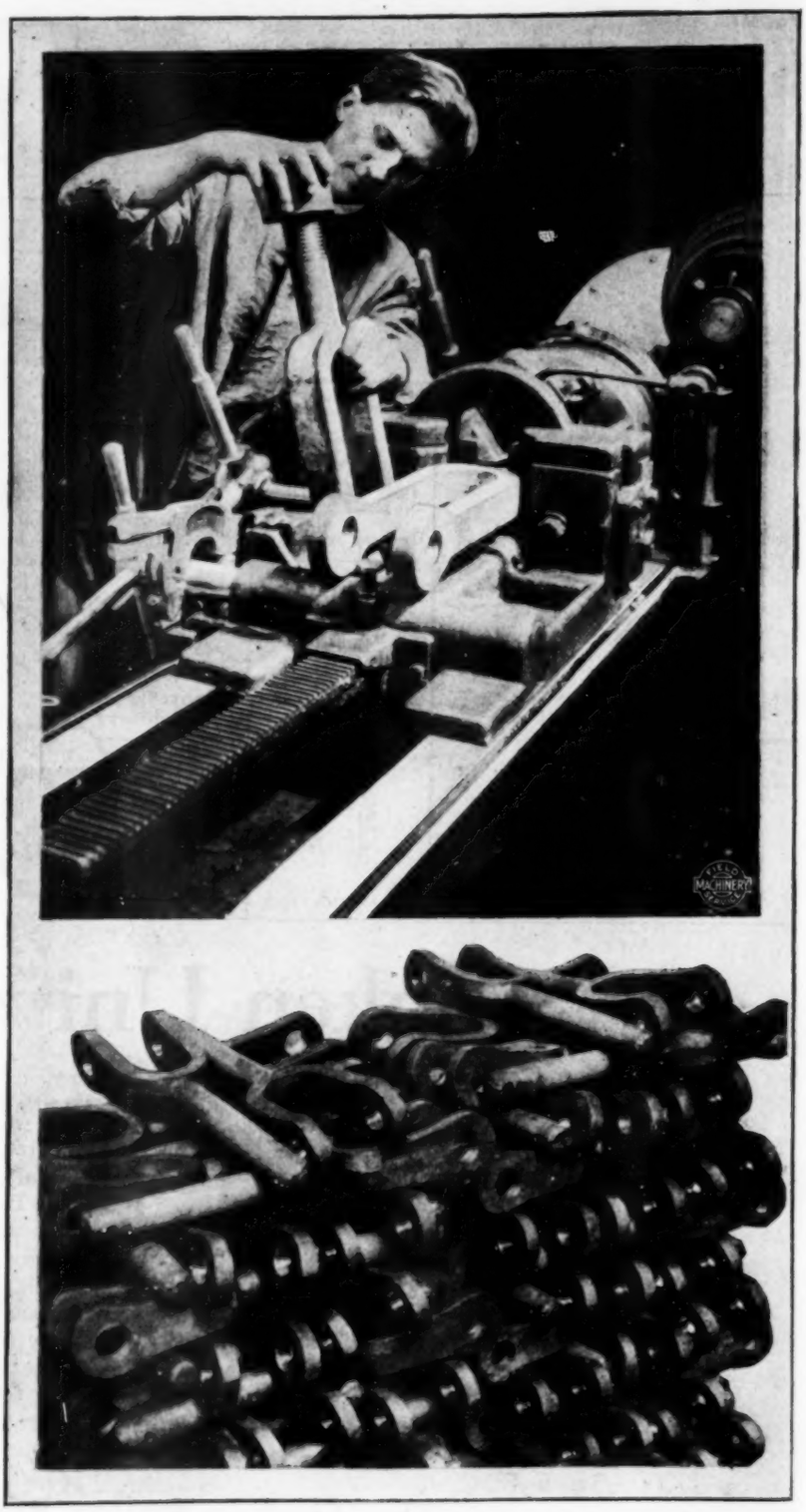
The Timken Roller Bearing Co
CANTON, OHIO

TIMKEN
Tapered
ROLLER BEARINGS

Around the World *with* LANDIS

Draw bars, coupling screws, adjusting screws, etc.—anything and everything requiring clean, true threads within the capacity of the 2-in. Die Head, is brought to this LANDIS Threading Machine—one of several in constant use for years in one of the Wolverton shops of the London and N. W. Railway.

The job shown is wrought iron beam joints, to be threaded a distance of 7 in. with a 1⅝-in., 5 per inch Whitworth pitch thread. Each completed thread is carefully inspected and tested by the young apprentice who operates the machine while the next is being cut; and production is uniform—2 minutes per piece.



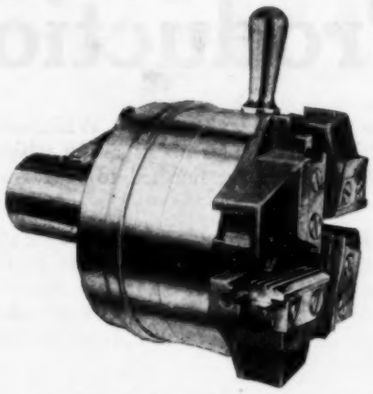
"Dies Last Long and Cut Good, Clean Threads"

The reputation of LANDIS Threading Machines in this English shop is the same as has followed them into practically every industrial center in the world. Let us describe their exclusive advantages.

Landis Machine Co.
Incorporated
Waynesboro, Pa., U. S. A.

LANDIS TRADE — MARK

DOMESTIC AGENTS: Marshall & Huschart Machinery Co., Chicago, Ill.; Marshall & Huschart Machinery Co. of Indiana, Indianapolis, Ind.; Colcord-Wright Machinery & Supply Co., St. Louis, Mo.; R. B. Whitacre & Co., St. Paul, Minn.; Hamilton Machinery Company, Chattanooga, Tenn.; Seeger Machine Tool Co., Atlanta, Ga.; Young & Vann Supply Co., Birmingham, Ala.; Woodward, Wright & Co., New Orleans, La.; Jos. T. Ryerson & Sons, Houston, Texas; Hendrie & Bolthoff Mfg. & Supply Co., Denver, Colo.; Salt Lake Hardware Co., Salt Lake City, Utah; Herberts Machinery & Supply Co., San Francisco and Los Angeles, Calif.; Harry M. Euler Co., Portland, Oregon; Hallidie Machy. Co., Seattle, Wash.; Hallidie Co., Spokane, Wash. CANADIAN AGENTS: Canadian Fairbanks-Morse Co., Toronto and Montreal. FOREIGN AGENTS: Alfred Herbert, Ltd., Coventry, England; Calcutta, India; Yokohama, Japan; Allied Machinery Co., Shanghai, China; Barcelona, Spain; Turin, Italy; Zurich, Switzerland; Stokvis & Zonen, Rotterdam, Holland; Lindeteves Stokvis, Batavia, Java; Dutch East Indies; D. Drury & Co., Johannesburg, South Africa; Benson Brothers, Sydney, Australia.



Precision Threading
Long Chaser Life
Maximum Production

LANDIS AUTOMATIC DIE HEAD

Long experience with LANDIS bolt and pipe threading machines gave a hearty welcome to this LANDIS Automatic Die Head. Used for threading bolts, studs and miscellaneous threading, it has well paid for itself.

The easy access to the chasers make changing from one diameter to another a quick operation. The variable rake angle and the tangential contact of the chasers make precision threading a certainty, while the long life of the chasers insures profitable threads and a very low cost of upkeep.

Do you cut threads on a turret lathe? If so, apply the LANDIS Automatic Head and reap the many advantages of this efficient tool.

Let us send full details. A letter to that effect will bring them without any obligation.

DOMESTIC AGENTS: Marshall & Huschart Machinery Co., Chicago, Ill.; Marshall & Huschart Machinery Co. of Indiana, Indianapolis, Ind.; Colcord-Wright Machinery & Supply Co., St. Louis, Mo.; R. B. Whitacre & Co., St. Paul, Minn.; Hamilton Machinery Co., Chattanooga, Tenn.; Seeger Machine Tool Co., Atlanta, Ga.; Young & Vann Supply Co., Birmingham, Ala.; Woodward, Wight & Co., New Orleans, La.; Jos. T. Ryerson & Sons, Houston, Texas; Hendrie & Bolthoff Mfg. & Supply Co., Denver, Colo.; Salt Lake Hardware Co., Salt Lake City, Utah; Herberts Machy. & Supply Co., Los Angeles and San Francisco, Cal.; Harry M. Euler Co., Portland, Ore.; Hallidie Machy. Co., Seattle, Wash.; Hallidie Co., Spokane, Wash.

CANADIAN AGENTS: Canadian Fairbanks-Morse Co., Toronto and Montreal.

FOREIGN AGENTS: Burton Griffiths Co., London, England; Allied Machinery Co., Shanghai, China; Stokvis & Zonen, Rotterdam, Holland; Lindeteves-Stokvis, Batavia, Java; Dutch East Indies; D. Drury & Co., Johannesburg, South Africa; Benson Brothers, Sydney, Australia.

LANDIS TRADE MARK

LANDIS MACHINE COMPANY

Waynesboro, Penna., U. S. A.

Doubles Former Production

When W. E. Arnold, Malden, Mass., maker of molds for rubber goods, installed this Whitcomb Planer it was with the distinct understanding that it must beat the production of another machine engaged in the same work in order to complete the sale.

We were sure of the result—he was a little dubious. As a matter of fact it has approximately doubled the best production of the competing machine.

The work shown here—finishing mold plates for rubber heels—is a typical example of Whitcomb production in this plant. The plates are machine steel, 7/16 in. to 1 in. thick, finished to limits of + .002 in.

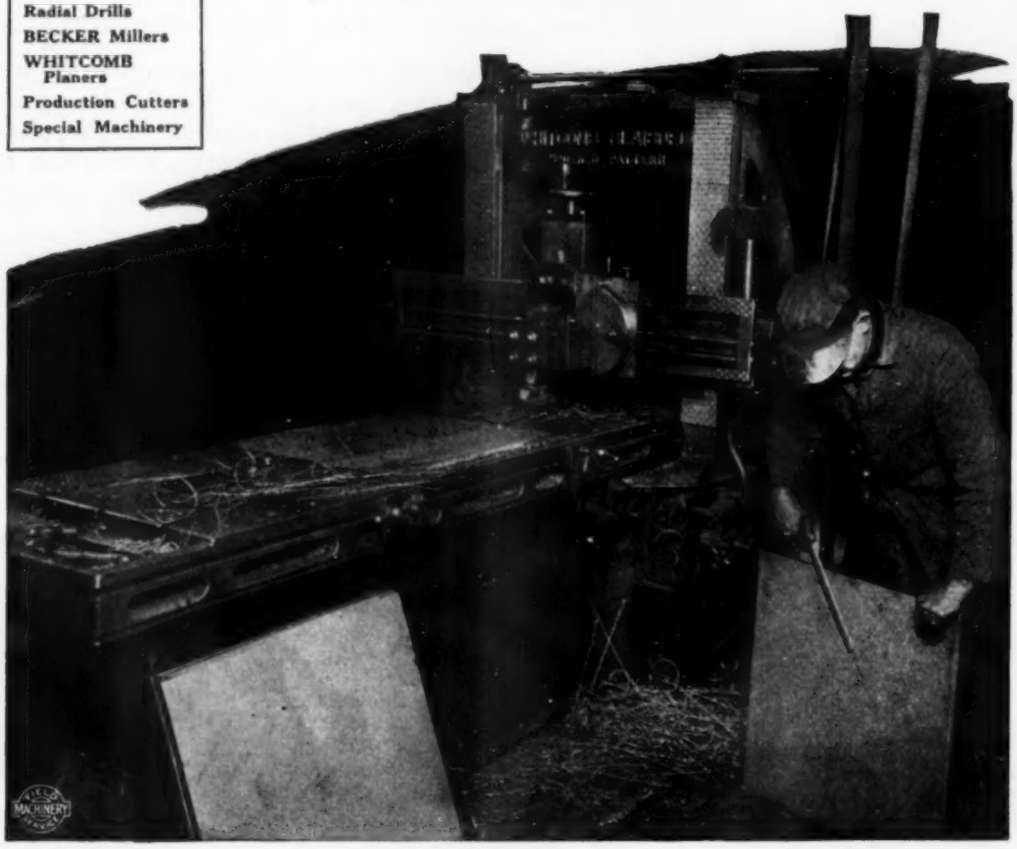
A gang tool-holder with four tools takes a cut ⅛ in. wide on a surface 25 in. long by 25 in. wide in 18 minutes with the table running at 60 ft. per minute. A plate 25 in. by 25 in. rough planed on both sides and finish planed on one side is completed in one hour—floor to floor.

Ask for more performance data on

Whitcomb Planers

REED-PRENTICE MACHINE TOOLS

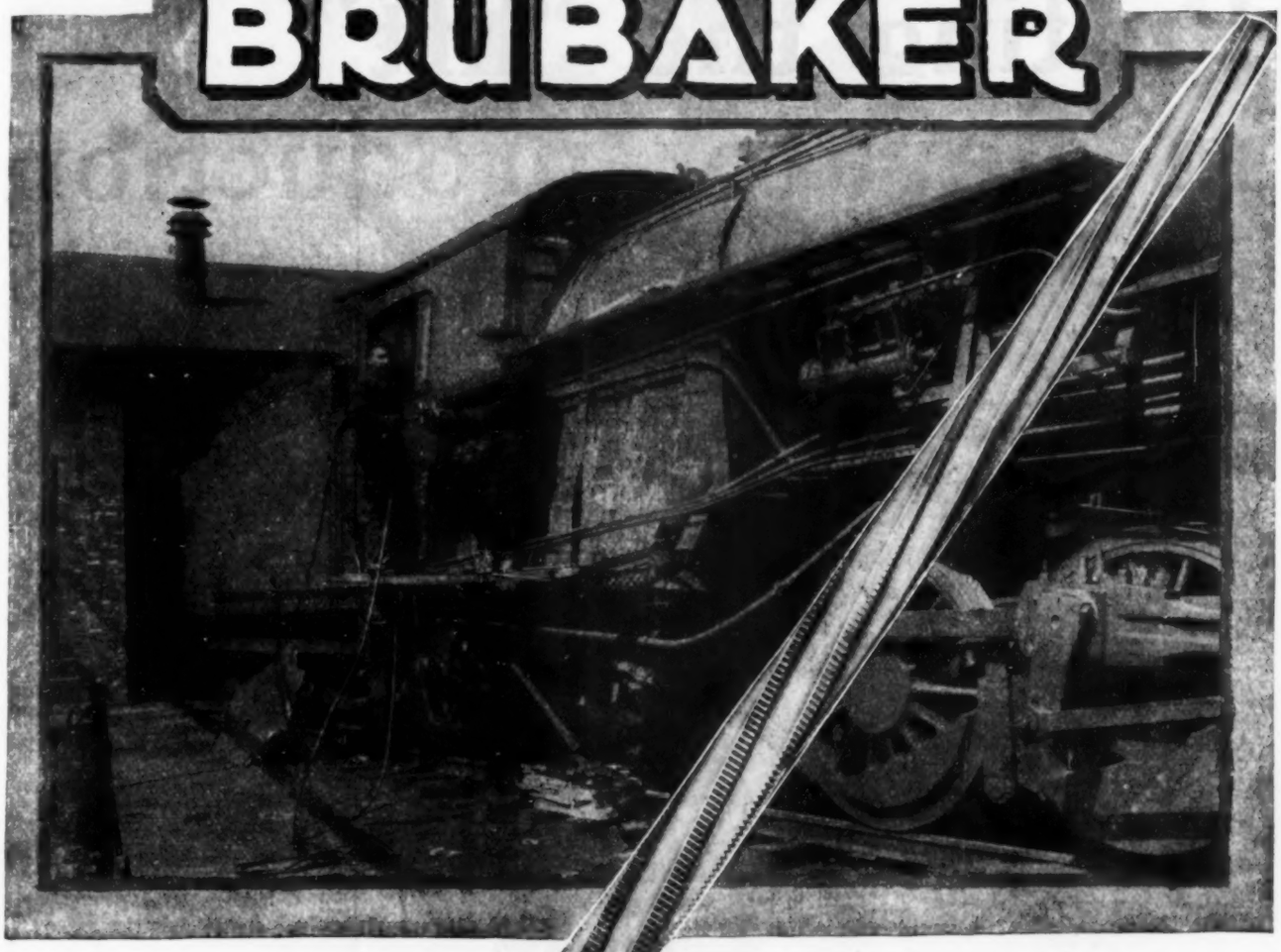
- Lathes
- Radial Drills
- BECKER Millers
- WHITCOMB Planers
- Production Cutters
- Special Machinery



REED-PRENTICE COMPANY

WORCESTER MACHINE TOOLS MASS., U. S. A.

BRUBAKER



Spiral Fluted Staybolt Tap

Patented
Patent No. 1434870

In An Emergency

A Brubaker Staybolt Tap to meet the most exacting conditions of repair work; retapping old sheets, cutting through mud, rust and scale.

THE BRUBAKER SPIRAL FLUTED TAP

has more bearing in the boiler plate, enabling the tap to cut a perfect hole.

A great feature of the spiral fluted tap is that it is a chip breaker throughout its entire length of flute; instead of curling the chips it breaks them, which allows them to pass readily along the flute, and at the same time keeps them from sticking in between the teeth.

For Detailed Description Locomotive Cyclopedia 1922

W. L. BRUBAKER & BROS. CO.

Millersburg, Pa.
50 Church Street, New York

Putting the "lift" in elevator production

Bullard Maxi Mills have been putting the "lift" in elevator production in the plant of the A. B. See Elevator Co. for a good many years—to be exact one **Bullard** has been on the job for over 18 years and a second is near the half score mark.

The **Bullard** shown opposite is turning the outside and inside diameters of Cast Steel Motor Pole Pieces.

Extremely close limits are required on this work yet one complete motor set — eight pole pieces — are set in fixtures, roughed and finished in remarkable time.

Extreme power, absolute rigidity to assure precision, high speed and simultaneous machining on inner and outer surfaces of the pole pieces make for profitable production.

The BULLARD MAXI-MILL is dependable under all working conditions. Every element in its construction has been proved by years of service.

On tough machining propositions, where close accuracy is the prime factor, it produces economically.

Bullard Engineers will convince you of the advantages of Bullard Equipment on your face plate work. Send prints for estimate.

BULLARD

MAXI-MILL

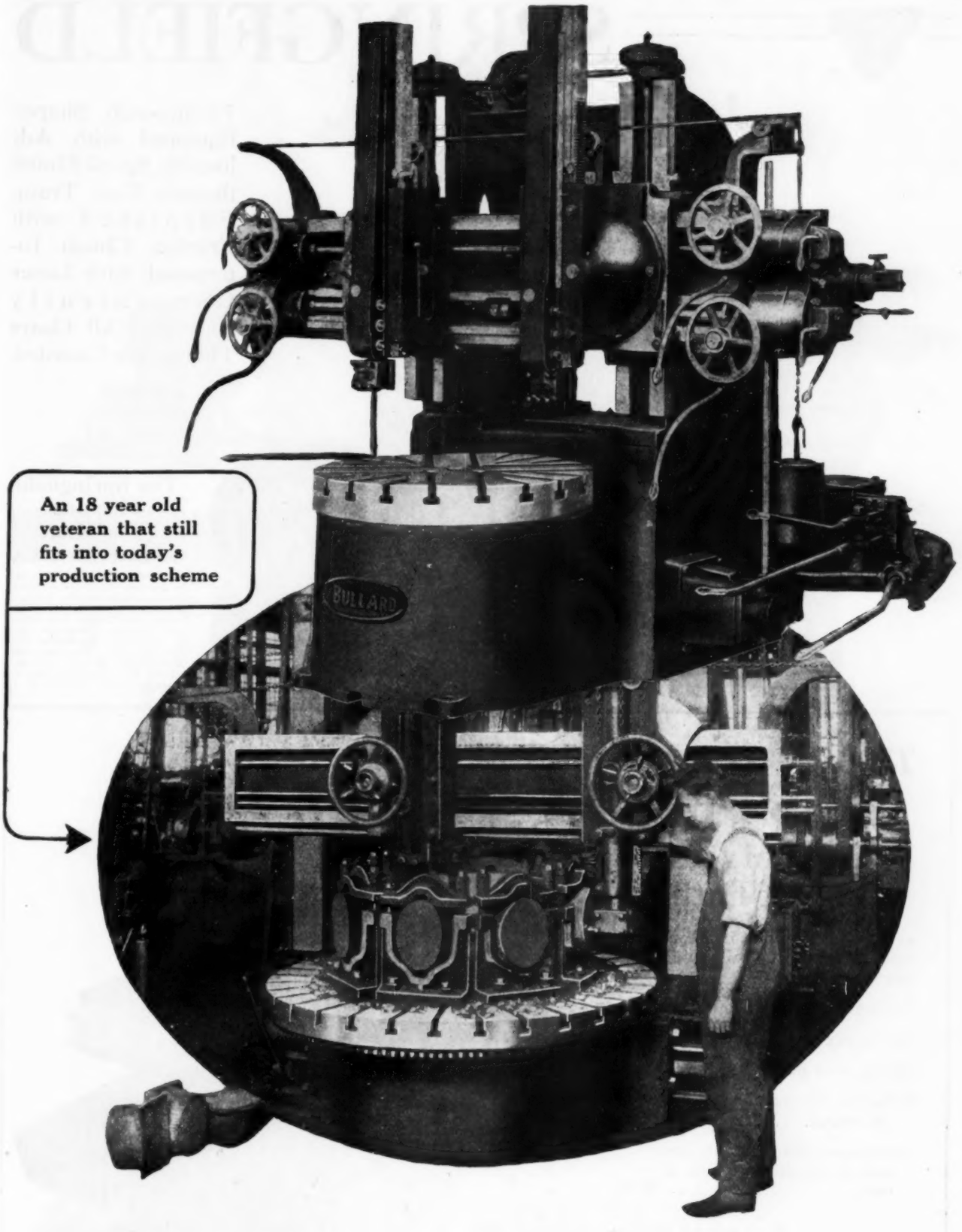
BULLARD
Maxi-Mill
44-in., 54-in., 61-in.

BULLARD
Vertical Turret Lathe
24-in., 36-in., 42-in., 54-in.

BULLARD
Mult-Au-Matic
8-in., 12-in., 16-in.

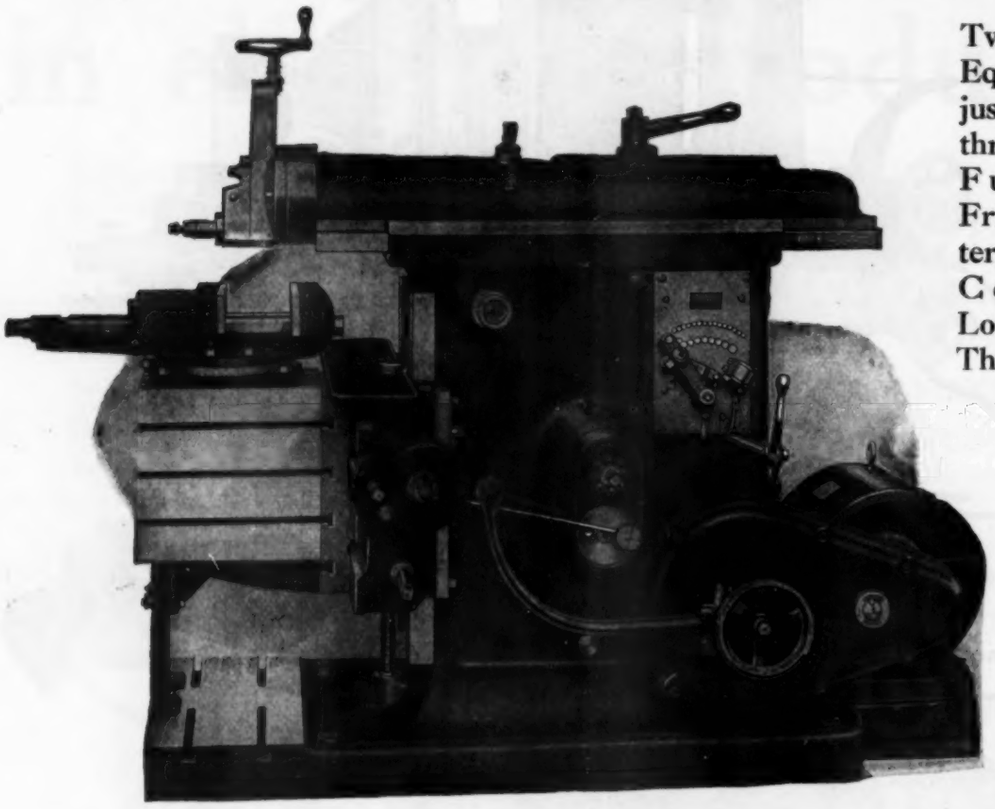
BULLARD
Contin-U-Matic
Chucking and Turning
10-in., 18-in.

The Bullard Machine Tool C



Co., Bridgeport, Conn.

SPRINGFIELD



Twenty-inch Shaper Equipped with Adjustable Speed Motor through Gear Train. Furnished with Friction Clutch Interposed with Lever Conveniently Located. All Gears Thoroughly Guarded.

Ask for Illustrated Catalog "J"

The Springfield Machine Tool Co.

Springfield, Ohio, U. S. A.

AGENTS: Manning, Maxwell & Moore, Inc., New York, Boston, Philadelphia, Buffalo, Syracuse, New Haven, Pittsburgh, St. Louis, San Francisco, Seattle, Cincinnati; The E. L. Essley Machinery Co., Chicago, Ill.; The Riverside Machinery Depot, Detroit, Mich.; The Cleveland Duplex Machinery Co., Cleveland, O.

The
FOSTER
1-B Universal Turret Lathe

as the name implies, is an all around machine, with the following capacities:

Automatic Chuck (round).. 2 in.

Swing over cross slide..... 8 in.

Swing over bed.....15½ in.

Effective movement of turret.....22 in.

Maximum distance between end of spindle and face of turret .....30 in.

Why not let us show you what this machine will do for you both on your short runs and your large?

FOSTER MACHINE CO.
ELKHART, INDIANA

A Norton Machine for Tool and Cutter Grinding

With a range that meets practically every demand of tool and cutter grinding as well as light cylindrical and surface grinding the Norton Universal Tool and Cutter Grinding Machine is ideally suited for the shop tool room.

It is made in two sizes — No. 1 which swings 8" and takes 15" between centers; and No. 2. which swings 10" and takes 32" between centers.

This machine complete with accessory equipment and attachments as shown is an exceptionally economical investment. Specifications and prices will gladly be furnished upon request.

NORTON COMPANY

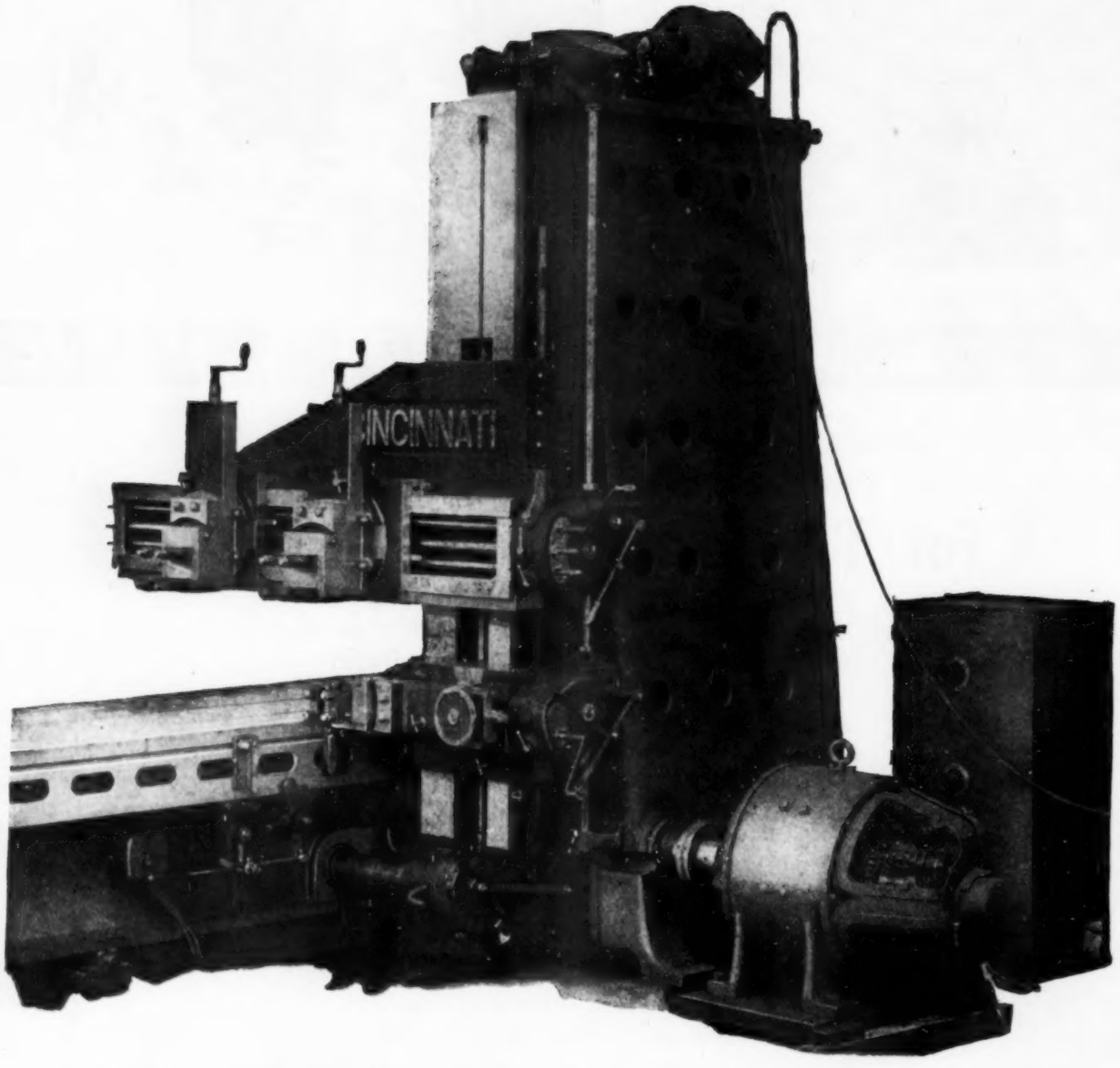
WORCESTER, MASS.

NEW YORK SYRACUSE CHICAGO CLEVELAND DETROIT HARTFORD PHILADELPHIA

M-100

CINCINNATI

OPEN SIDE PLANERS



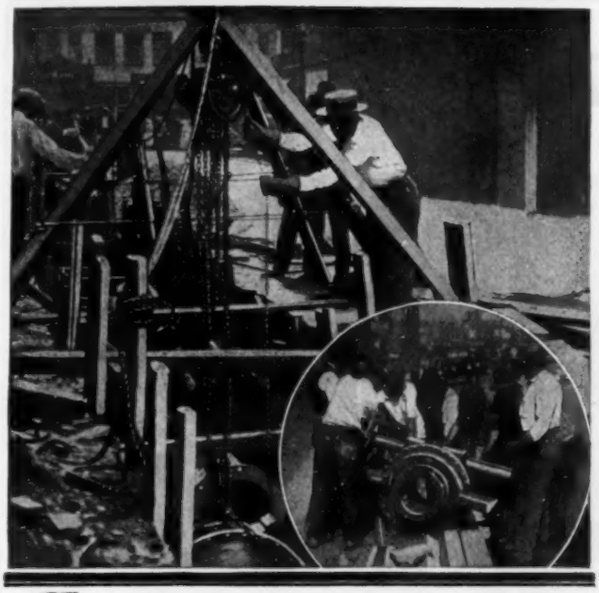
A planer that has no superior.
Designed to meet all requirements.
Equipped with CINCINNATI'S well known features.

Rapid Power Traverse, Forced Lubrication, Tu-Speed Drive, Herringbone Gears, Box Table and Arch.

PLANERS
BORING MILLS

Our Catalog Gives Full Description

THE CINCINNATI PLANER CO., Cincinnati, Ohio



CYCLONE HOISTS
HIGH SPEED

We Saw this Example of Labor Saving From Our Office Window!

IT took nine husky men, with many a "yo" and a heave, to place this ponderous fitting in position for lowering into a trench dug by the Cleveland Electric Illuminating Co. for laying the steam pipes to the new Union Trust Building, Cleveland.

When hooked to the Cyclone Hoist, rigged over the trench, one man alone lowered the same heavy weight into position!

One never need go far to find places where a Cyclone Hoist can save labor and cut costs. Perhaps *you* need only look out *your* window into your factory yard, your shop or warehouse to see instances where a Cyclone Hoist can profitably replace muscle-methods. Look!

Send for catalog covering 1 to 40 Ton Hoists Cranes, Trolleys and Overhead Track Systems.

DISTRIBUTORS EVERYWHERE

The Chisholm-Moore Mfg. Co.
Cleveland, O.

Hoists Cranes Trolleys
Overhead Track Systems
Branches: **New York, Chicago, Pittsburgh**

You can't eat your cake and have it—*Old Proverb*

A century or so ago some bewhiskered old chap discovered that once one has eaten one's cake, one cannot longer have it. Cake, of course, being synonymous for everything consumable.

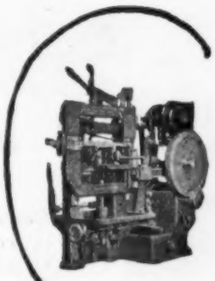
And there's no use denying it; the old boy was right. Which brings us around to an important item of waste—preventable waste, happily.

In many average lathe, milling machine and shaper operations about 20 per cent of the metal involved is reduced to chips—wasted! Formerly it would have been merely lost, but now it is wasted because its loss is unnecessary.

The Peerless Universal Shaping Saw operates with extreme rapidity on much work ordinarily done on a miller or shaper and it does not waste metal. It leaves no chips and consumes stock only the thickness of its blade. Contrast this saving of metal with the loss that may be occurring in your shop. Then get full details about the Peerless Universal Shaping Saw itself.

Peerless

Still Faster
UNIVERSAL SHAPING SAW



If you get only one new idea out of "A New Departure in the Sawing of Metals" it will be worth much more than the trouble of asking for it.

PEERLESS MACHINE CO.
1358 Clark St.
Racine, Wisconsin

Gray Planers

DURABLE

Long life and freedom from wear can be secured only by adequate and unfailing lubrication. The following features incorporated in Gray Maximum Service Planers are therefore of the utmost importance:

1st. V's are flooded with filtered oil.

2nd. Gears run in a bath of oil.

3rd. Driving shaft bearings are flooded with filtered oil.

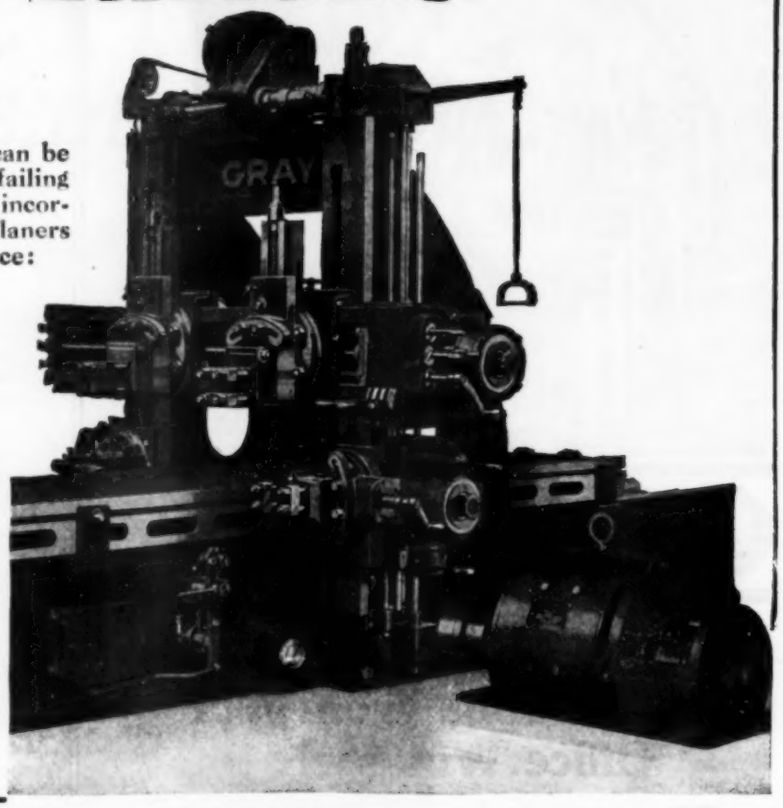
4th. Feed and rapid traverse gears run in oil.

5th. Rail, side heads and top works are lubricated from centralized oil reservoirs.

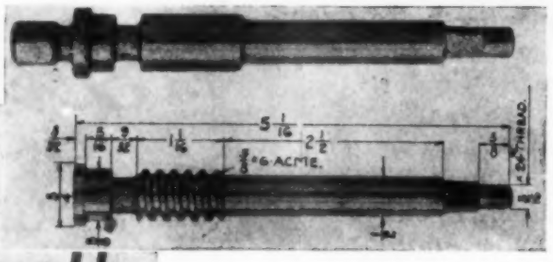
May we tell you of the many other features that make the Gray Maximum Service Planers so easy to take care of and also such big producers?

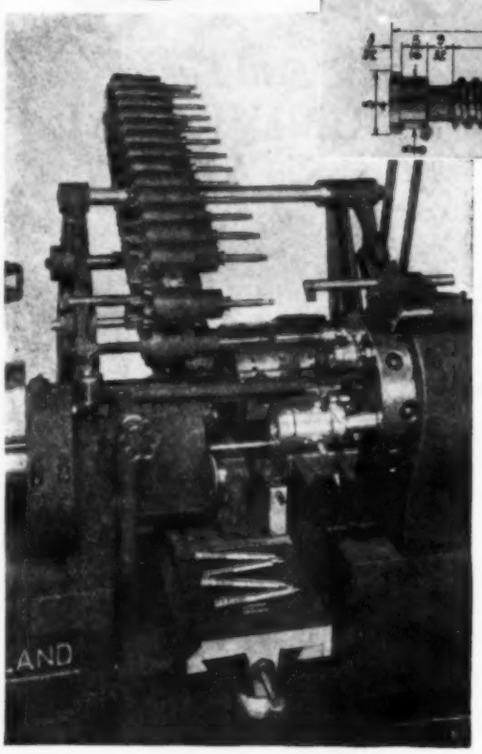
Write for our fully illustrated Catalog

THE G. A. GRAY CO.
CINCINNATI, OHIO



CLEVELAND'S CAPACITY UNEQUALED





Finishing 1 in. Globe Valve Spindle Castings—

at the rate of

124 per minute

Illustrating a practical application of the Magazine Feed

Conveyor carries part from magazine to chuck.

A circular tool necks casting while a straightening block straightens from the front cross slide. This operation is followed closely by the Three Tool Roughing Mill from the turret which rough turns three diameters and finish turns small thread diameter.

A two tool finishing mill turns the Acme thread diameter and ½ in. diameter, the large S. O. Die Head cuts the Acme thread and is followed by the small S. O. Die Head which cuts the small thread on the end of the spindle.

The ¾ in. and ⅝ in. diameters are finish formed on the end while the spindle is cut off from the rear cross slide.

The operations are timed to follow rapidly, some overlapping the preceding operation.

Wouldn't this kind of a Cleveland application save money on some of your parts? We'll gladly furnish you full details upon request.

The Cleveland Automatic Machine Company
Cleveland, Ohio

Another Good Job
for a
GARDNER DISC GRINDER

GARDNER-GRINDING is the Ideal and Most Economical Method of Finishing Jobs Such as This!

Name: Woodworker's vice jaws.

Approximate area: 30 sq. in.

Approximate stock removed: 1/16 in.

PRODUCTION: 70 per hour complete (2 operations necessary, roughing and finishing.)

Machine used: No. 6 Gardner Disc Grinder; 26-in disc wheels; lever feed table.

Abrasive disc used: No. 126 G. I. A.

Fixture used: 90° angle plate with studs for backing up. Piece not clamped.

"Gardner-Grind Your Flat Surfaces"

Gardner Machine Company

410 E. Gardner St., Beloit, Wis., U. S. A.

Bigger Savings on Small Threading Operations

GEOMETRIC Bench Threading Machines, equipped with Geometric Rotary Die Heads, are big factors in raising production and minimizing machining losses on small threaded parts.

They are practically indispensable in the manufacture of interchangeable parts. Compactness is an outstanding feature and sturdy design insures long service life.

Geometric
Bench Threading Machine

weighs but 90 pounds and takes bench space of only 9½x29 inches.

The 5/16-in. Geometric Rotary Die Head with which the machine is fitted cuts threads of standard and finer pitch on diameters 1/16 in. to 5/16 in. inclusive. The machine is arranged for bolting to a bench, or it may be mounted on a separate pedestal for floor use.

Let us show you some of the savings it will make on your work

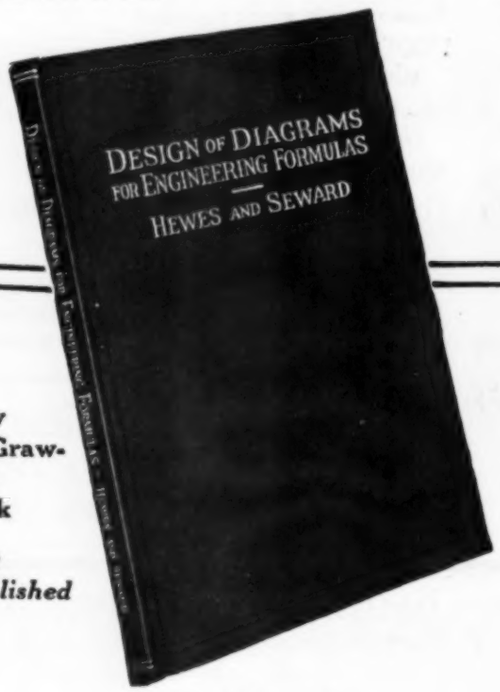
The Geometric Tool Co.

New Haven, Conn., U. S. A.

The Art of Designing Diagrams for any Formula

No one who has been called upon to solve repeatedly an engineering formula of considerable resistance can fail to appreciate the usefulness of an accurate diagram which immediately gives the value of the unknown in the most complicated formulas of standard use.

Here is a book that will enable any engineer to understand better the diagrams that are published from time to time.



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Just Published

Hewes and Seward's

Design of Diagrams for Engineering Formulas

And the Theory of Nomography

112 pages, 9x12, 83 diagrams, $5.00 net, postpaid

This is the first comprehensixe textbook published in this country, covering the entire field of the design of nomograms or permanent diagrams for the solution of formulas of engineering, physics, finance or other sciences. It develops the entire theory from the simplest concepts to a point never before attempted.

The book will enable any engineer to master the art of designing diagrams for any formula he is likely to need.

The book contains 80 selected diagrams from the simplest function scale to the most comprehensive and elaborate diagram for the solution of the equation of the fourth degree. These diagrams are alone worth the price of the book to any engineer.

Diagrams for such important formulas as Kutter's formula for the flow of water in open channels, Green's formula for the transfer of heat, the so-called Open Belt formula, Bond Valuation, etc.

Examine the book free—send only the coupon.

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You may send me on ten days' approval: **Hewes and Seward's Design of Diagrams for Engineering Formulas, $5.00.** I agree to pay for the book or return it postpaid within 10 days of receipt.

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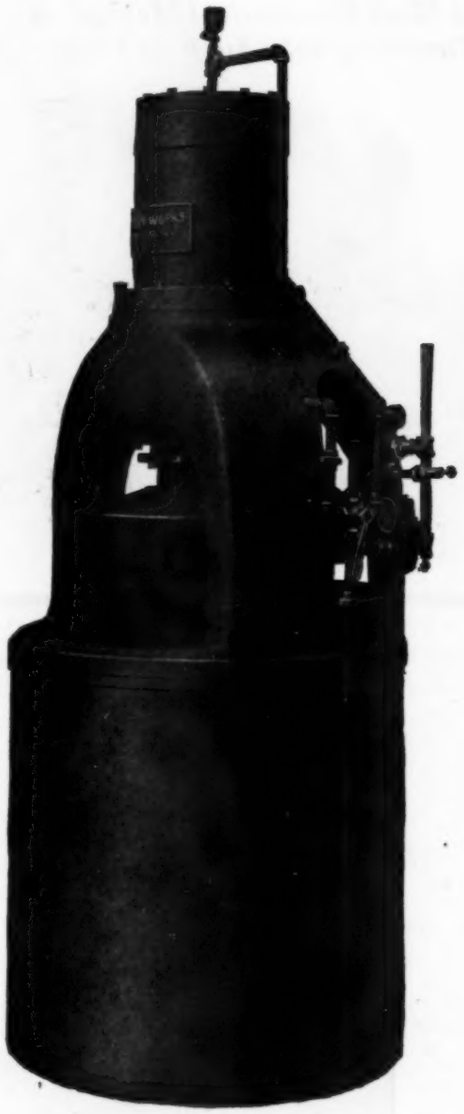
GLEASON

25-in. Quenching Press

New Design

for

Bevel and Internal Gears



Distortion of Bevel Gears during heat treatment the cause of many rejections and losses. Insure yourself against it.

Write for full particulars

GLEASON WORKS

ROCHESTER, N. Y.

Cold Rolled Special Steel Doesn't Stop the "Gray"

Down at Pensacola, when this picture was taken, there was a rush demand for sea-planes—yet every man on the job realized that one faulty step in workmanship might cost several lives.

That's why they turned over their intricate sheet metal cutting to the

GRAY'S Sheet Metal Cutter

for there is no more speedy, yet easily controlled machine. The radiator braces shown, 18 ft. x 5 in., are cut from 3/16-in. C. R. Special Analysis Steel at the rate of 18 per hour—about 200 seconds per piece!

The Gray feeds itself—follows any pattern, and doesn't need to begin at the edge. It takes out a kerf, like a jig saw in wood—no burrs or buckling.

The foreman of the Sheet Metal Shop stated "One of the best and most useful machines in the shop."

To see this machine in operation is a revelation. Let us refer you to a near-by installation.

W. J. SAVAGE COMPANY, Inc.

Knoxville, Tenn.

European Agents: Alfred Herbert, Ltd., Coventry, England

GRAY'S Sheet Metal Cutter

Outstanding Accomplishments of the "WRIGHT" Design

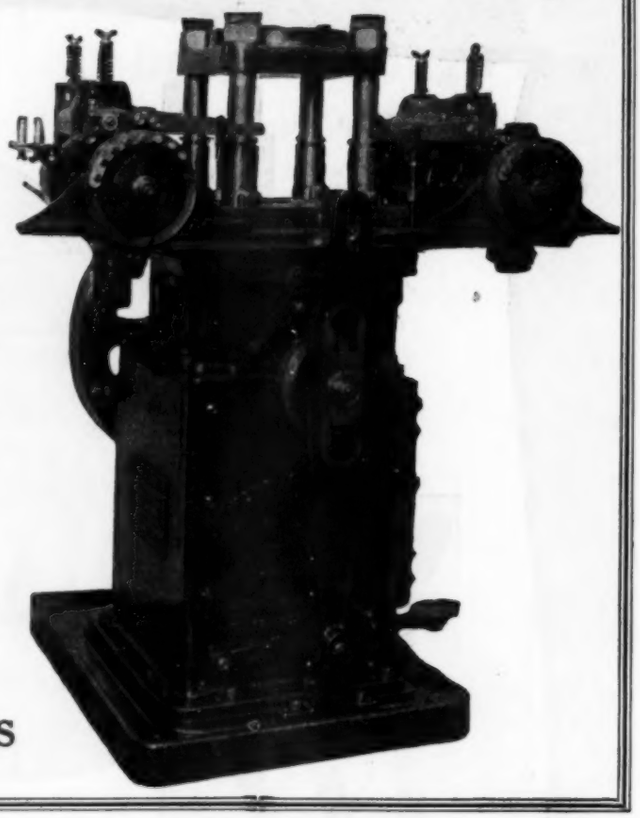
More parts per hour—Because the underslung flywheel is mounted low—underneath the dies—more revolutions per minute is possible without the usual vibration of overhead flywheels. More R.P.M. = more parts per hour.

Labor cost cut to the bone—The automatic feed rolls does away with slow hand feeding—the interruptions due to operator fatigue and, most important—**one man can oversee a whole battery of Wright Dieing Machines.** Easily equipped with magazine for 2nd operation bending and forming.

Longer Die Life—The four steel guides working in adjustable bronze bushings **makes every Die a sub-press Die.** Positive alignment at all times—a better grade of work and a surprising increase in life between grinds are just a few benefits from the revolutionary WRIGHT principles.

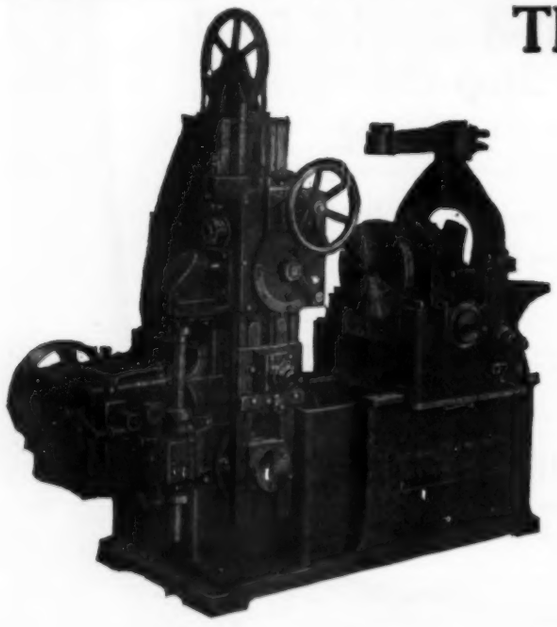
Freedom From Shifting Labor—The "greenest" hand after **one hour's instruction** can equal the output of the most competent Punch Press Operator, because WRIGHT DIEING MACHINE production isn't dependent upon human skill—it's entirely automatic.

Get in step by sending for the Wright Dieing Machine catalog —or send us your prints for a production estimate—there's no obligation in any way.



The Henry & Wright Manufacturing Co.
Hartford, Conn., U. S. A.

DRILLING MACHINES **DIEING MACHINES**



The better the cam the bigger the output

Smooth machine movement permits of higher speeds and, consequently, increases hourly production. Lower cost per part is what the plant manager of today is insisting upon.

The **Rowbottom Universal Cam Milling Machine** has an established reputation for producing cams of the highest quality.

Cams of every known style can be fashioned on it, and sixteen feed changes adapt it to metals of every sort.

The **Rowbottom** has every modern feature for the furtherance of high-grade production.

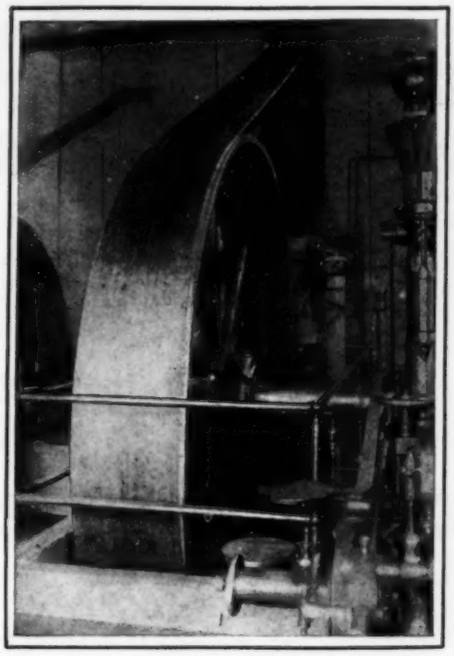
It will pay you well to install the **Rowbottom.** It will also profit you to let us cut your cams in our own shops.

Rowbottom for Cams

Full details will prove the advantages of incorporating Rowbottom Cams in your products. We are ready to furnish them.

The Rowbottom Machine Co.
Waterbury, Conn.
Factory: Waterville, Conn.

Nothing takes the place of **Leather**



They have paid for themselves several times

THE right belt in the right place. The right quality of leather, the right tanning methods, the right weight, flexibility and thickness to transmit the right amount of power—this is what the Graton and Knight Standardized Series of Belts means. And this is belting economy.

Out in the Middle West the manager of a large mill after making several severe tests with different sorts of belts decided to rebelt his entire mill with leather. Among the leather belts that were used for making the tests were some members of the Graton and Knight Standardized Series.

The Graton and Knight Belts stood the tests so much better than any of their competitors that they were chosen for the job.

And this is what the manager of the mill* wrote us some years later:

> "Some of your belts have been running for several years and as they are in as good condition as when they were installed we are unable to give you any opinion as to the length of service we will get out of them, but at this time we are convinced that they have paid for themselves several times."

Send for the book "The Standardization of Belting," and at the same time let us know the type of power transmission you are most interested in. This book tells how, through constant study and analyzation of transmission problems, we have developed a series of belts to meet every condition.

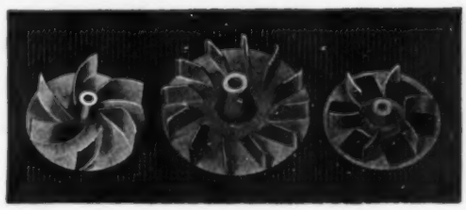
We will gladly have a Graton and Knight engineer call upon you and place at your disposal one of the widest belting experiences in the world.

*Name upon request.

GRATON & KNIGHT
WORCESTER, MASS.

GRATON & KNIGHT

DOEHLER
The World's Largest Producer of
DIE-CASTINGS



To produce one good die-casting, is one thing. To produce ten thousand or a hundred thousand of those die-castings, equally good, is another thing.

Absolute uniformity of quality, dimensions and finish can be maintained only where the die-casting producer realizes his responsibility, willingly assumes it, and makes provision accordingly.

The voluntary replacement of worn dies with new ones, without cost to the customer, is only one of the factors which have established the Doehler reputation for producing die-castings absolutely uniform in quality, whatever the quantity.

DOEHLER DIE-CASTING CO.
BROOKLYN, N.Y.
TOLEDO, OHIO.

"There's "a kick to it"—

"He profits most who serves best!" isn't an axiom to pin on the wall.

It's a basic business principle and the guiding element behind the production of Butterfield Threading Tools.

That's why a rapidly increasing number of representative concerns are adopting Butterfield Taps. They've found out you can't spend 43 years doing one thing without doing it supremely well.

Our Special Tools department is in excellent position to turn out Reamers, Taps and Dies to your specifications Estimates gladly furnished upon receipt of prints.

BUTTERFIELD THE BETTER TOOLS

The whole line of BUTTERFIELD TOOLS is listed in Catalog No. 18—have you a copy?

BUTTERFIELD & CO. DIVISION

Union Twist Drill Co.

Derby Line, Vt., U. S. A.

Stores: **New York, 62 Reade St. Chicago, 11 So. Clinton St.**

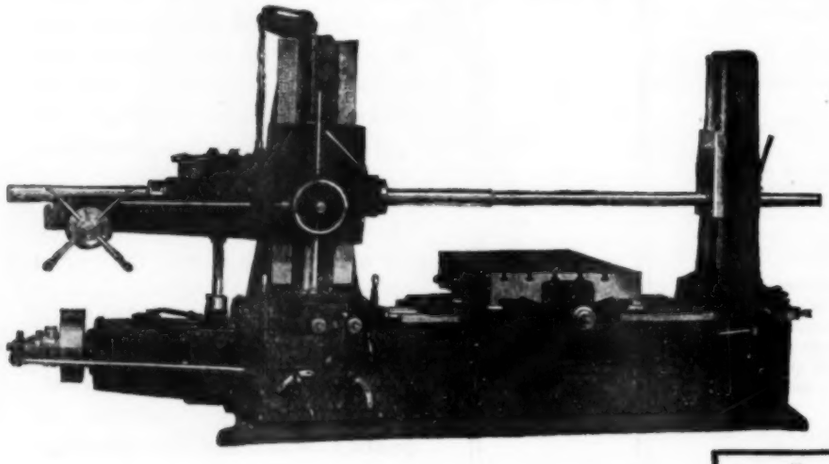
Toronto, 220 King St., West. Montreal, 131 St. Paul St., West

FOREIGN REPRESENTATIVES: Great Britain, **Geo. H.** Alexander Machinery, Ltd., 83-85 Coleshill St., Birmingham, England; France, Italy, Belgium and Switzerland. R. S. Stokvis & Fils, 20 and 22 Rue des Petits Hotels, Paris, France; Sweden, Norway and Denmark. Ab. Sigfr. Anderson & Co., Malmo; Spain, Defries Sociedad Anonima Espanole, Cortes 587, Barcelona; Japan. Abe-Kobel & Co., Yokohama; Greece, Stephen C. Stephanson, 11 Lycourgan St., Athens; Netherlands, Wynmalen, Hausman, Rotterdam; Australia, Maurice Gandry c/o Arkell & Douglas, 9 Young St., Sydney.

DOMESTIC REPRESENTATIVES: Pittsburgh, Somers, Filter & Todd Co., 327 Water St., Mill Supply Co., Erie, Pa.; Philadelphia, Diamond Specialty & Supply Co., 15 N. Sixth St.; St. Louis, Handlan-Buck Mfg. Co.; Cincinnati, J. R. Wood Supply Co., 917 Broadway; Wayne Hdw. Co., Ft. Wayne, Ind.; The Bond Supply Co., Kalamazoo, Mich.; Smith & MacKay, 428 Jefferson Ave., East, Detroit, Mich.; Indianapolis, Vonnegut Machinery Co., 19 West South St.; San Antonio Machinery & Supply Co., San Antonio, Tex.; Georgia Mill Supply Co., Albany, Ga.; Meadows-Price Co., Roanoke, Va.

Some of our friends, under the obsession of commercialism, say that we make the

"PRECISION" BORING DRILLING AND MILLING MACHINE



Too Good!

But—aside from pride in our product—we are convinced that a machine that lasts twice as long will find more than twice the market.

Lucas Machine Tool Co.

Cleveland, Ohio

U. S. A.

WE ALSO MAKE THE

LUCAS POWER Forcing Press

Good Tools Reduce Maintenance Costs

Saving a few hundred dollars by purchasing cheaper machine tools is often a costly "economy."

From the minute such tools start work, they commence to waste repair money. This may continue for 20 years.

For the sake of future maintenance costs, only the most efficient machine tools deserve consideration. In a lathe this means the Ryerson-Conradson machine.

Ryerson-Conradson Engine Lathes embody such work-speeding features as centralized operating controls, shifting of feeds and speeds while the spindle is in motion, and unusual facility of thread-cutting. On the average shop jobs they have reduced the time consumed by 25%.

Bulletin 1301 *gives the details—Ask for it*

JOSEPH T. RYERSON & SON INC.

Established 1842 Incorporated 1888

PLANTS: CHICAGO ST. LOUIS DETROIT CINCINNATI BUFFALO NEW YORK

BRANCH OFFICES: MINNEAPOLIS MILWAUKEE DENVER TULSA HOUSTON SAN FRANCISCO

RYERSON MACHINERY

Saves time and eliminates guesswork

The **Hartness Screw Thread** has risen to a practically indispensable position in the screw-thread production departments of modern manufacturers.

It never fails to show faults in threads and their true nature—a thing impossible with the "feel" methods of gauging. More than this, it is ten times faster in operation than hand checking systems. Users of the

Hartness Screw Thread Comparator

can reduce their inspection force and save the loss due to rejecting threaded parts that do not "feel" right, yet are not too faulty for use.

The **Hartness Method** will make similar savings in your plant that it has in hundreds of others.

Let us explain all its points of advantage

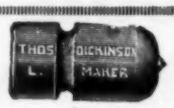
Jones & Lamson Machine Co., Springfield, Vt., U. S. A.

"Universal" Hack Saw Blades

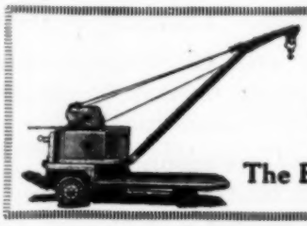
Our hack saw missionary man will be glad to demonstrate the superior quality of these famous blades.

MILLERS FALLS TOOLS

MILLERS FALLS CO.
Millers Falls, Mass.
Manufacturers of Carpenters' Tools, Hack Saws and Automobile Tools



DIAMOND TOOLS for MECHANICAL and SCIENTIFIC PURPOSES
Our tools are all stamped "Dickinson Maker, N. Y."
We are proud of a long record for satisfactory service
THOS. L. DICKINSON, 38 Gold Street, New York City
Successor to John Dickinson **Established 1796**



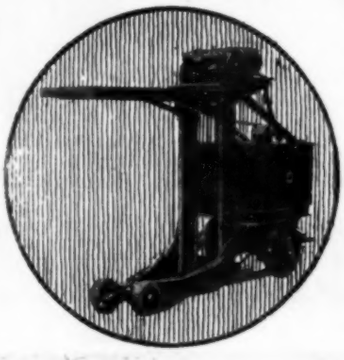
Electric Industrial Crane Truck
One of 25 Types Each Built for Special Lift and Carry Service
Request Catalog 811
The Elwell-Parker Electric Co.
Cleveland, Ohio

Appearance

is a sales factor in machine tools. **Rockwood Pressed Steel Machine Handles** are neat, light and uniform in shape. They possess a strength that ably resists any operating strain. **Rockwood Handles** are hollow and seamless. Made in eleven sizes to meet every handwheel and lever need. Send for samples and prices.

Rockwood Sprinkler Co. of Massachusetts
General Manufacturers of Pressed Steel Products.
Worcester, Mass.
London Office: 147 Queen Victoria St., E. C. 4

LAKEWOOD TIER-LIFTS



Will Lift the Burden of High Handling Cost in Your Shop—

For handling dies, stacking tin plate, unloading motor trucks, piling in the stock room, transporting and elevating 4000 lb. loads up to heights of 96 in., the Lakewood Tier-Lift can serve you.

The application of the trucks may be readily seen in photographs.

Send for Series "A"

Lakewood Engineering Co.
Cleveland, O.

American Machinist
Volume 59 NEW YORK, DECEMBER 27, 1923 Number 26

That Repair Order!

By H. S. RIGGS
Advertising Manager, The Lodge & Shipley Machine Tool Co.

A system of handling repair orders quickly, without necessitating personal attention, as practiced in the plant of the Lodge & Shipley Machine Tool Co., Cincinnati, Ohio

"—and please rush it!"

That was the closing sentence in a letter from The Brown Co., to which was attached an order for repair parts. It happened that the lathe for which repairs were wanted had seen 23 years' service. It was of obsolete design and not all of the parts wanted were in stock. The Brown Co. wanted its order filled immediately, and yet hundreds of other repair orders were going through the shop, most of which were "rush" jobs. It is human nature to "want what you want when you want it." The reason the average machine shop wants its repair jobs rushed must be because shops were trained during the war to have all equipment in tip-top shape and they still are, more or less, under the spell. An idle lathe attracts a lot of attention and in a short time becomes a "white elephant" to everyone who works near it.

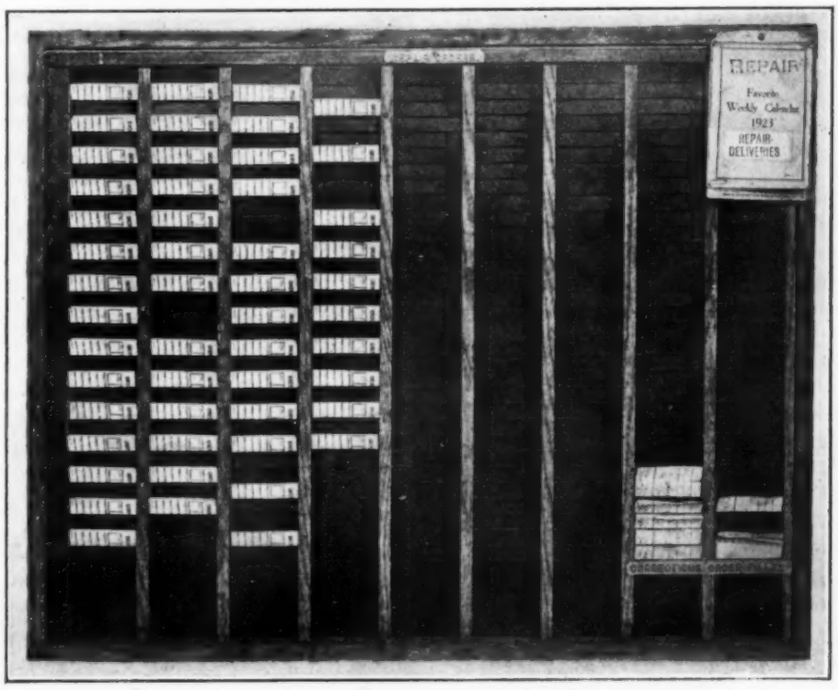


FIG. 1—REPAIR ORDER CONTROL BOARD
Requisitions for parts short on an order are filed in this board until finished. As they are finished the requisitions are taken out. The parts are stored in bins until the order is completed. Complete record of why held can be had instantly.

But getting back to the business of filling the order: If a man insists on having his order filled quickly, it must be done and when many orders are received every day, each marked "rush," a system of handling orders, one that is absolutely fool-proof, must be used. To this end Lodge & Shipley has gradually improved its system of handling repair orders, so that today a maximum number of "rush" jobs can be run through the shop, each automatically getting the best possible attention.

When the Brown people sent us their order, they, of course, were concerned only with that particular one, whereas we have hundreds of others that are in just as big a hurry. We, however, want to further the belief that their order is the only one we have to think about. In doing this a feeling of satisfaction is brought about that all of us want when we buy something. In handling a large volume of business this would be impossible without a good reliable system. Let's see how it works. In the commercial office the order is given a number by which it will be identified and indexed in the Repair Order Book. It is acknowledged and a promise is given to name the delivery date within a few days. The order is then sent to the engineering department, where it is analyzed. First of all the lathe serial number is verified from a machine record file. The drawings for all L. & S. lathes are keyed under this serial number. After the serial number, size, length of bed and style of headstock, given by the customer, check up against our records, the drawings for the parts wanted are looked up.

On the machine card are the construction numbers

of all the units which make up the lathe, such as the headstock, tailstock, carriage, apron, etc. If a part of the carriage is to be replaced, the parts list for the carriage assembly is located and from it the piece and drawing numbers of the parts wanted are secured. From the drawing number the tracing is located and a blueprint is made. This blueprint accompanies the repair order in all its travels throughout the shop. As a matter of fact, each repair order is accompanied by a blueprint from which accurate and detailed information can always be secured.

It can be appreciated that with drawings for a great number of styles of lathes, made within the last 31 years, it would be difficult to supply repair parts if a system such as this were not maintained.

Shop Clerical Details

After the order has been interpreted and the drawing number and piece number located, the data are written out on what is termed a Parts List, *A*, Fig. 5. Five carbon copies of this parts list are made. One copy goes with the envelope, *B*, to the repair department; one copy to the works office; one to the stock control desk; one is kept as a permanent record in the engineering department; while the original is sent to the cost department to be held for pricing. Experience has shown the importance of these five copies.

After the parts list is written, the order sheet, *C*, is made out, showing the order number, size, machine number, piece and drawing number, and names of the parts. Four carbon copies are made, as shown in *D*. These are for the works office; shop assembly department; engineering department; and the shipping or packing list. They are each of a different color so as to make them readily distinguishable. The engineering department copy is kept as a permanent record. The works office copy goes out just as soon as the repair order is written so that the works manager, his assistant and the tracer will know just what is coming through the shop. The tracer's copy stays in envelope *B*, and the shipping copy is turned in on completion of the order to the shipping department.

When Parts Are in Stock

The shop copy, shipping list, and shop parts list, together with requisitions calling for the parts on order, all in envelope *B*, are sent to the "finished stock keeper" to fill. If all the parts called for are on hand he fills the order and sends it to the inspection department. From there it is packed and shipped. When the parts are in stock the order is not held up for the shop credentials, but is shipped immediately, the records being completed later.

In case he is short any of the parts called for, he writes out a green shortage slip, *E*, Fig. 7, which is later posted in the Repair Order Control Board, Fig. 1. The tracer is then called upon to fill these shortages. The green slips, together with the parts on hand, are sent to the repair assembly department, Fig. 2. If advisable, a part shipment is made. If not, the parts on hand are tagged and stored in one of the bins shown in the illustration.

In the works office the order is looked up. What does it call for? Parts that must be made up; parts that are in stock finished; or parts which can be purchased finished? The piece and drawing number of the parts wanted are looked up and that information determined. The envelope and parts list are sent to the stock control desk for reservations. The parts list shows just what parts are wanted and gives the quantity, piece and drawing number of each.

The stock control cards, *F*, *G*, and *H*, Fig. 7 (finished piece, raw stock and purchased finished) covering the piece number of parts called for on the parts list, are then taken out to determine just what pieces are on hand. The stock control card for the first item listed on the parts list is taken out and a reservation is made for the quantity called for. On each card is marked a low limit and the quantity that should be ordered when the low limit is reached. If the reservation calls for more pieces than are on hand a new lot is started through the shop. The quantity ordered through is posted on the stock card and from this can be determined later just how many are in process.

Ordering Castings

After reserving the new lot, the raw stock card, *H*, is looked up to determine how many raw castings are on hand. If a new lot is necessary, the reservation is posted and an order for the pattern to be sent the foundry is sent to the pattern shop. The castings are then ordered and the name of the maker of the castings posted on the raw stock cards. A pattern notice is sent to the casting tracer who keeps a continual check on the order to insure its prompt delivery. The first item on the parts list is then checked and the quantity ordered shown. The same procedure holds good with all other items on the parts list.

Routing the Order

The works office parts list and envelope are then sent to the engineering department. There the element blueprint for the parts specified is made and sent with *B* and *A* to the routing department. This is done to be sure to include any new pieces designed since the previous lot was routed. There, the routing card, *I*, is issued, put into envelope *B* and returned to the works office.

In the meantime a shop copy has been sent to the storekeeper and a correct account of all parts on hand and short, of those called for, is given and sent to the assembly department.

In the works office the traveler tag, *J*, Fig. 6, the time tickets, *K*, the cost cards, *L*, the tracer shortage, *M*, Fig. 7, and the master follower tag, *N*, Fig. 6, are written out. The routing is copied from *I*, the routing card. The cards are sent to the following departments: Traveler tag to the raw stores; time ticket to the timekeeper; cost card to the cost department; tracer shortage to the works manager's Master Shortage Book (a copy of this goes to stock tracer); master tracer tag to the works office control desk.

Keeping the Order Moving

The parts not in stock must, of course, be made up. The raw stock called for on the traveler tag is sent to the first operation. As soon as the job is sent to the first operation a "Shop Tickler," *O*, Fig. 6, is sent to the foreman of that department. The shop tickler has on it complete information and is a simple and direct means of informing the foreman of that department of the number of jobs in his department and how long he has had each. This card is hung up on a board over his desk. It is obvious that with the date of issue stamped in large figures on it, continually reminding the foreman how old it is, he will exert his best efforts

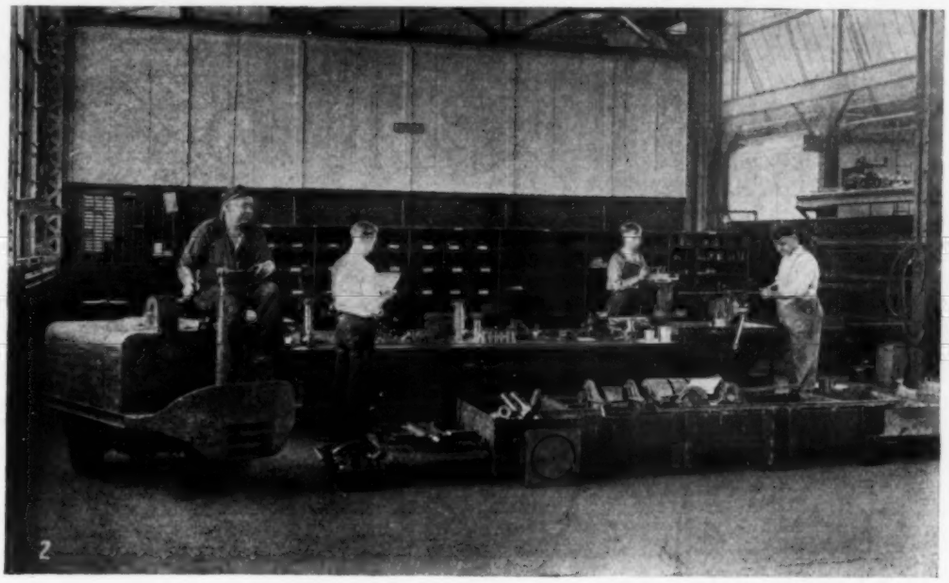


FIG. 2—REPAIR ASSEMBLY DEPARTMENT

All repair orders are assembled here. If some parts are short, the available parts of each order are stored in bins which are marked with the repair number. The parts short are represented by green shortage slips which can be seen in the board at the extreme left of the picture. The tracer is checking over parts preparatory to having them taken to the inspection department by the electric mule seen at the left.

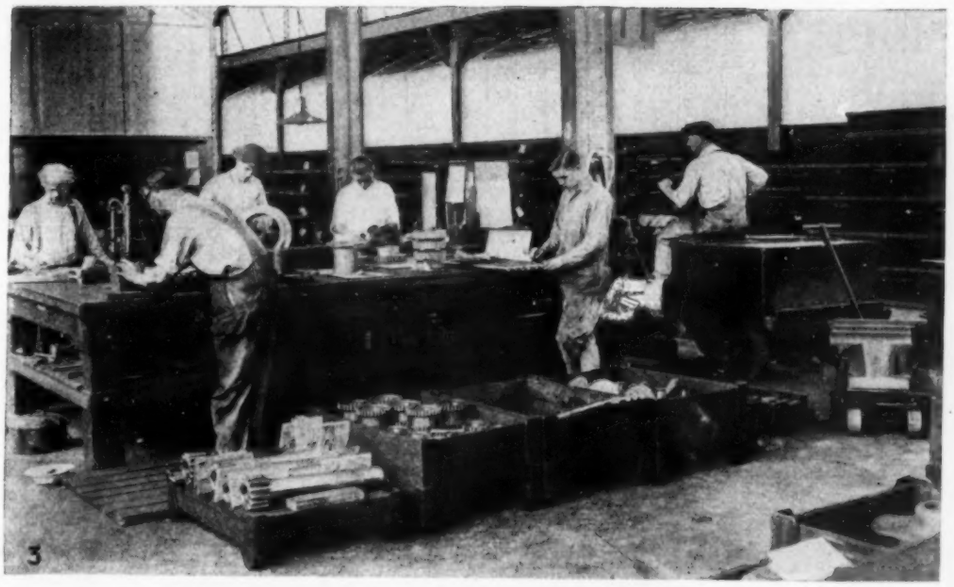


FIG. 3—INSPECTION DEPARTMENT

All jobs are inspected here before being taken to the next department specified on traveler tag. This arrangement insures that the job will be finished correctly by all departments. Note the electric mule at right, about to haul away three tailstocks.

FIG. 4—SHIPPING DEPARTMENT

All repair orders upon completion are brought to this department. The parts are checked against the packing list and boxed. The shipping clerk meanwhile has received notice that the order is ready for shipment, and has prepared tags and documents. The shipments are then hauled to a place where they are picked up and forwarded parcel post, express, or freight, according to instructions.

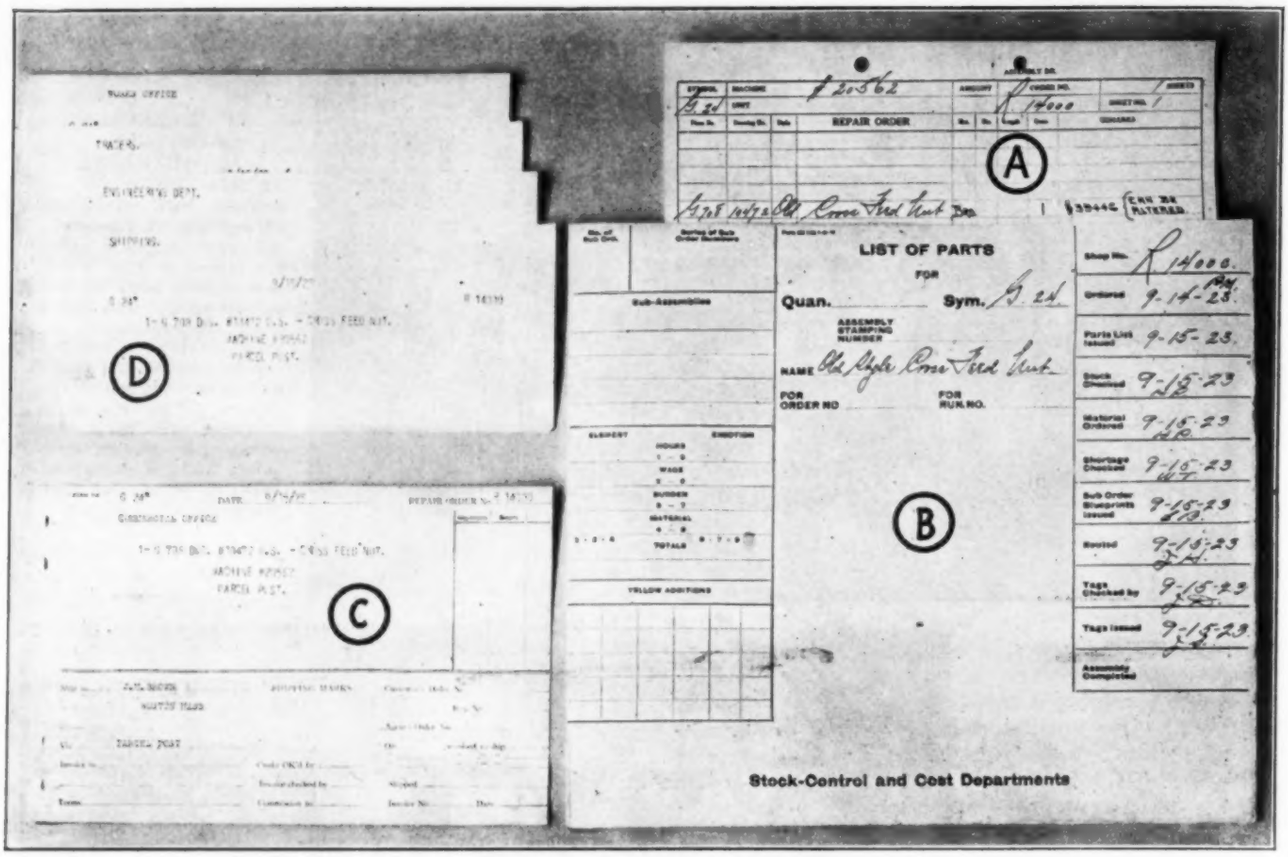


FIG. 5—FORMS FOR REPAIR ORDERS
A, Parts list. *B*. Parts list envelope. *C*. Commercial office order sheet. *D*, Order notification slips for shipping department, engineering department, tracers, and works office

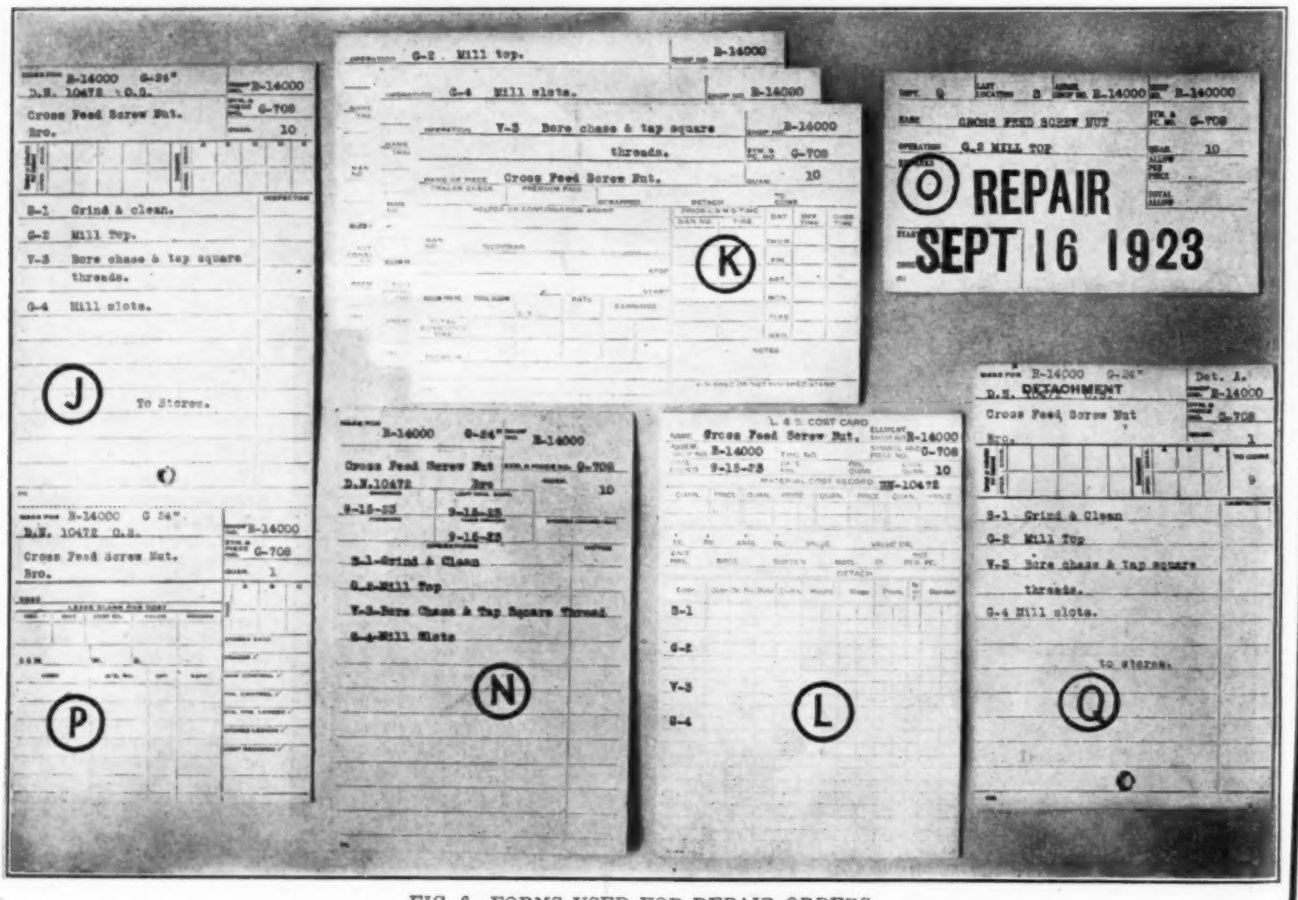


FIG. 6—FORMS USED FOR REPAIR ORDERS
J. Traveler or follower tag. *K*. Time tickets. *L*. Cost card. *N*, Master tracer tag. *O*, Shop tickler. *P*. Weight stub. *Q*, Detachment tag

to get rid of the older dates as quickly as possible. This has been found a very effective method of keeping jobs moving in the sequence in which they are received.

The master tracer shortage is checked daily. The operations are dated and when the job fails to move, the look-up tracer is sent out to find out why. The follower tag calls for material out of stock. The weight tag, *P*, is torn off and sent to the tracer clerk, notifying him that the job has been sent to the first operation called for.

A metal signal is clipped on the master tracer, opposite the first operation, after a shop tickler has been sent to the department where the first operation is to be done. This tickler is sent out just as soon as the master tracer is filed in the control desk. When the time ticket on the first operation is received by the tracer posting clerk the workman's number is posted and the signal is pushed up to the top right-hand corner of the card. The position of this signal notifies the tracer clerk to type the shop tickler for the next operation. After this is done the signal is placed opposite that operation and the date when the tickler is sent out is marked next to it. This is repeated for each operation. The value of such a proceeding is in knowing at any time just where the job is and to be able to determine quickly the reason, if any, for its delay.

When the last operation is performed, the job is sent to the finished stock room and the stockkeeper looks over the shortage requisitions and sends all parts just received, that are short, to the assembly department. All operations are carefully followed by the shop tracer on shortage and also cross-checked by the works manager's office on tracer shortage. This means a double check.

A Detachment

When it has been found necessary to make up any of the parts called for, a lot of that particular part is run through the shop. In the case of the cross-feed screw nut as shown on *Q*, Fig. 6, a lot of 10 pieces has been ordered through. However, if this particular order is urgently needed and one cross-feed nut is wanted as quickly as possible, a short cut is necessary. A detachment, *Q*, is made out. It is similar to form *J*, only it calls for one nut with nine to follow. All shop and cost cards made out when *J* is issued are duplicated when a detachment is made, with the exception of the requisition, *R*. The procedure through the shop is exactly the same as was explained for the regular lots only the foremen recognize a detachment as something that is in a hurry and give it preference over other jobs.

Through means of this detachment it is possible to bring through in advance one or more pieces of a lot and thereby save considerable time. This method, of course, does not require personal attention, but accomplishes the same thing on jobs that must be rushed. It goes without saying that with such a procedure the costs are necessarily higher, but when a job must be had quickly that is to be expected.

Inspection

Each department has its "Move Station," a spot marked off on the floor. Each foreman is responsible for any job in his department up to the time it is put into the move station. The responsibility then goes to the trucking system. Truckers, operating electric mules, call at each depot at regular intervals. The jobs are placed on lift trucks and pulled to the next department as specified on the traveler tag, after they have first been taken to the central inspection department, inspected and punched. The inspection department also has its move station, and this insures prompt removal of all jobs which have been inspected. Each operation is inspected, thereby avoiding delay by detecting the part spoiled or defective before it is finished.

After each operation is performed the work is sent to a central inspection department, Fig. 3, and carefully inspected before being sent to the next department, or before the next operation is done, as designated on the master tracer. This arrangement insures correct work

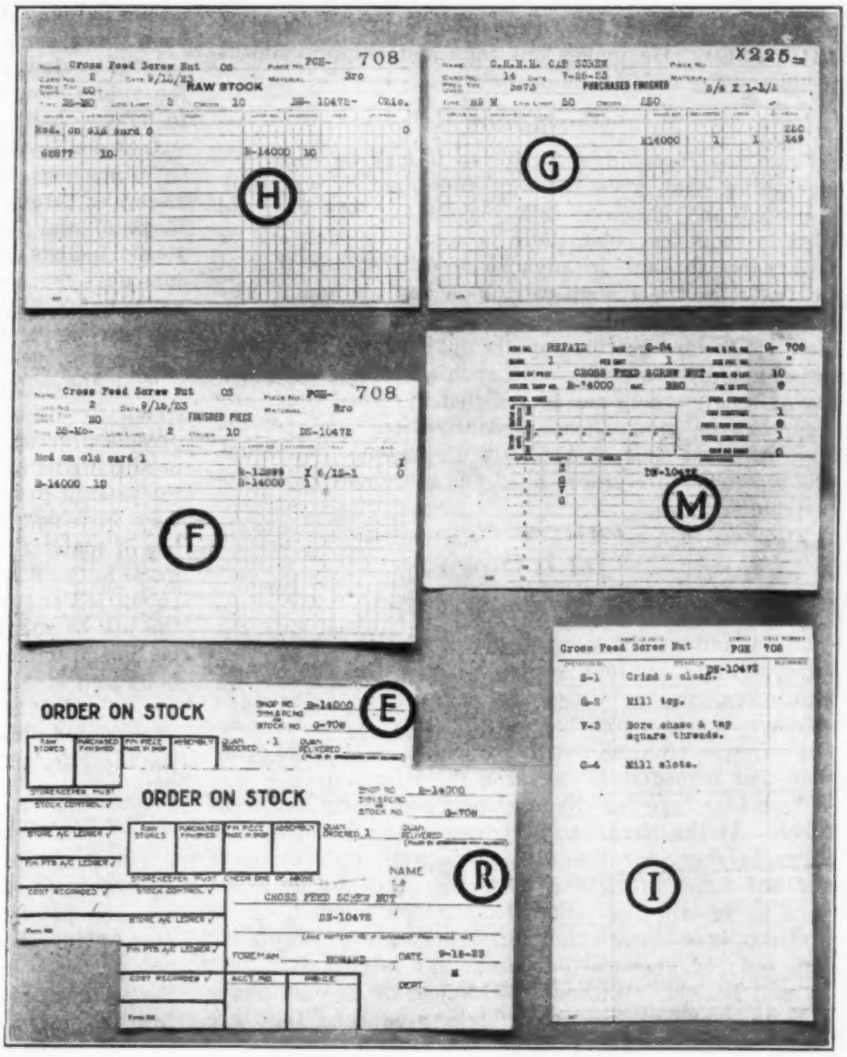


FIG. 7—FORMS USED FOR REPAIR ORDERS
E, Green shortage slip used in control board. *F*, *G*, *H*, Stock control cards. *I*, Routing card. *M*, Tracer shortage. *R*, Stock requisition

from the very start. When the assembly department has received all parts called for on the parts list, the parts are assembled and taken to the inspector's desk and checked. From there they are taken to the shipping floor, Fig. 4. Accompanying the order is the shipping list.

Another inspector checks over the parts against the shipping list and then the job is painted and all machined parts are slushed. The order is then ready for packing. The shipping list is packed with the order and the number is marked on the outside of the box by the packer. The shipping clerk has in the meantime received his copy of form *D* (marked SHIPPING). He makes out tags and shipping documents and the order goes on its way.

Conclusion

From the foregoing description it may be seen how everything that goes through the plant is carefully inspected and checked; how orders are received and filled in sequence; that there is a way to rush one or more parts through in advance of others; and that at no time does the system rely upon any one man. The responsibility is divided so that all have a part in doing their bit toward getting repairs out with as little delay as is humanly possible. With such a system, any quantity of repair orders can be handled in record time; any order can be given "preferred attention" and yet not take up extra time on the part of any one individual. The result is more orders filled and more satisfaction to customers.

Jot It Down

By W. Roland Needham

Often amidst the routine of calculations or design, some thought or idea registers upon the active consciousness, and at times the suggestions seem quite worthy, and apparently merit careful consideration. More frequently than not they apply to some issue other than that immediately engaging the attention.

Such ideas are for the most part extremely shy creatures. At the time, one's impression is that they are there to stay, for the illusion is well nigh complete and one feels instinctively that the ideas can be called upon or re-called at will. That is the illusion. It is probably true enough that few ideas are ever absolutely lost, but for practical purposes they might often just as well be lost. Without mechanical or precautionary aids they are seldom recallable at the time they are really needed. They probably lie more or less deeply sunk into one's subconsciousness, and it will require some happy coincidence—some striking parallelism—ere the timid creature can be enticed across the threshold into the open of one's work-a-day consciousness.

What does persist is just the tantalizing, annoying recollection that whatever the idea was, it seemed to promise well for good and useful service.

These ideas—inspirations, rather, when they are of the highest order—need never lapse into the abyss at all, because the fugitive, ephemeral thing can be caught, caged, and produced at will. The remedy is, once the suggestion comes, to snatch there and then a minute or two from the task immediately in hand, in order simply to note down the salient points.

Should a runaway idea return, one should see to it straight away that it does not escape again. When the wanderer returns, the trap should be ready.

Bolt-Heads, Nuts and Wrench Openings

In March, 1922, the Sectional Committee for the Standardization of Bolt, Nut and Rivet Proportions was organized under the rules of procedure of the American Engineering Standards Committee by the American Society of Mechanical Engineers and the Society of Automotive Engineers acting as joint sponsors. A subcommittee, designated as No. 2, was appointed to report on wrench bolt-heads and nuts and, after obtaining and analyzing data covering practice in the United States and abroad, has submitted a tentative report for circularizing. Although the data in this report have been given some publicity, the subcommittee desires a careful review of them by all industries followed by the submission of whatever criticisms they may have to offer.

Included in the report is an analysis of the variations in dimensions for corresponding bolt sizes that exist generally throughout the industry in the United States, England and Germany. The recommendations in the report include dimensions of the heads, heavy nuts and jam nuts for rough and finished square and hexagonal bolts, finished light nuts, finished hexagonal and square cap screws and the corresponding wrench openings required to fit properly.

The dimensions for the heavy and light nuts correspond to those used by some manufacturers in their present practice, but the subcommittee states that it has not been able to prepare tables of sizes that would meet the present practice of all industries, although the tendency in recent years has been toward more economical use of material for screws, bolts and nuts such as those made to the S.A.E. standard. This part of the report is submitted particularly for consideration looking toward the use by all industries of a single standard for bolt-heads and nuts, using only light-nut dimensions for $\frac{3}{4}$-in. bolts and smaller except that the width across flats of the $\frac{7}{16}$-in. bolt be made $\frac{11}{16}$ in. instead of $\frac{5}{8}$ in. The tables of proposed dimensions, however, include the heavy nuts for the $\frac{3}{4}$-in. size and smaller and the $\frac{5}{8}$-in. width across flats for the $\frac{7}{16}$-in. size.

Tolerances for Rough and Finished Products

The proposed tolerances are from basic to minus for all bolt-heads and nuts and from basic to plus for wrench openings to provide sufficient wrench fit clearance. The amounts of tolerance have been selected for "rough" and "finished" products, "rough" finish pertaining to stock made by cold or hot pressing, punching or forging, but not to semi-finished products made by any process. The "finished" class of products pertains to bolt-heads and nuts that are machined all over and includes those that are semi-finished by any process.

After the report has been approved by the Sectional Committee, it must be submitted to and approved by the sponsor societies before it can be finally approved by the American Engineering Standards Committee as American Standard. It is very desirable, however, that the proposal be carefully reviewed by the industries before a final report is drafted. Criticisms by all those interested in the manufacture and use of these products are solicited. Copies of the subcommittee's report in pamphlet form may be obtained on request to the American Society of Mechanical Engineers, 29 West 39th St., New York City, and written comments on the report should be addressed to the Chairman of Subcommittee No. 2, Sectional Committee on Bolt, Nut and Rivet Proportions, at the same address.

The New Thread Standard—VI

By RALPH E. FLANDERS
General Manager, Jones & Lamson Machine Co.

Provisions for special threads and fits in the Screw Thread Report of the A.E.S.C.—"Mixing the fits" to minimize tooling expense — Tables and charts showing tolerances

IT HAS been made sufficiently plain that the Screw Thread Report presented by the Sectional Committee of the American Engineering Standards Committee is intended to apply only to certain standard thread sizes for bolts, machine screws, nuts, commercial tapped holes, etc., so far as setting definite standards is concerned. It is recognized, however, that the tolerance tables may prove useful in special thread sizes, and to cover this contingency the following instructions are given:

IV—CLASSIFICATION OF FITS

3—SPECIAL CONDITIONS

(a) *Conditions Requiring Special Fits*—In cases where looser fits are required than those given by the above named classes, the use of the Loose Fit of the National Screw Thread Commission is recommended.

The Loose-Fit Tables are placed in the appendix of the Sectional Committee's report, and are here given as Tables VI and VII for guidance in all cases where an especially loose fit is required. It should be observed that this fit provides for an *allowance*. That is to say, the maximum pitch diameter of the screw is smaller than the minimum pitch diameter of the nut, so that there is always some shake even on the closest fit possible. This construction permits threaded parts to be rapidly spun together, and allows also for easy assembly under field conditions, where the threads may be filled with dirt or hardened grease. The loose fit is expected to be particularly applicable to threaded ammunition components, and to other parts used in warfare.

APPENDIX C—TOLERANCES FOR LOOSE FITS (CLASS 1)

This fit is recommended whenever an *allowance* is required between the maximum screw and the minimum nut, and in the cases where larger tolerances than those given by the Free Fit (Class 2) are needed.

This class of screw threads will be defined and specified as follows:

Minimum Nut is Basic.

Maximum Screw is Below Basic: The major diameter and pitch diameter of the maximum screw will be below basic, in accordance with the diameters specified in Tables VI and VII.

Direction of Tolerance on the Nut: The tolerance on the nut will be plus.

Direction of Tolerance on the Screw: The tolerance on the screw will be minus.

Tolerance Values: The tolerances on a screw or nut of given diameter and pitch will be such as to result from the dimensions given in Tables VI and VII.

While the Class 1 or Loose Fit is the only one in which an allowance is definitely provided for, a virtual allowance will result from ordinary manufacturing practice in the Class 2, Free Fit, and in the Class 3, Medium Fit, as well. When plug and ring gages are used, they will be made to a manufacturing tolerance which tends to keep the finished work from the extreme sizes. The "Go" plug gage, for instance, will be made correct within a range of from basic to 0.0001 or 0.0002 in. large. It will never be made smaller than basic. The minimum tapped hole will thus tend to be slightly larger than basic. This tendency will be accentuated by the desire of the workman to keep away from the extreme condition in which the "Go" plug gage screws in with difficulty.

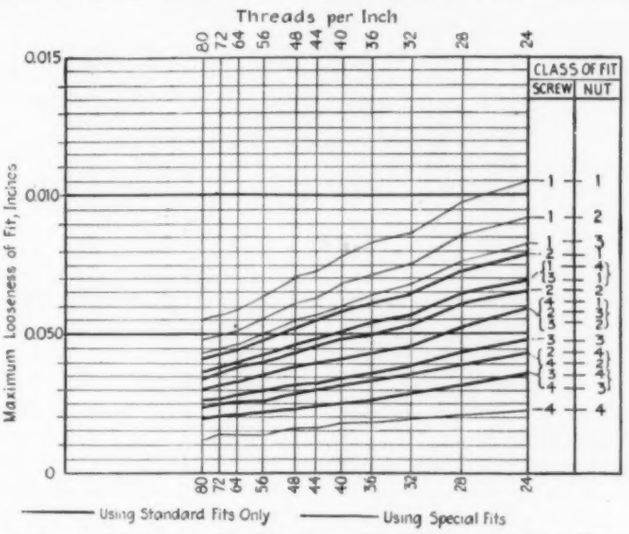


FIG. 9—CHART SHOWING FOR NUMBERED SIZES THE MAXIMUM LOOSENESS OF FIT OBTAINED BY MIXING SCREWS AND NUTS OF DIFFERENT CLASSES OF FIT

The same conditions operate on the ring gage to keep screws and bolts well below basic; and the combination of the two produces the "virtual allowance" referred to above. The same condition, but in a greater degree, results from optical inspection of screws and taps, in which the natural tendency of the operator is to keep near the safest area at the middle of the tolerance range. The effect of gage tolerances on the final fit of the thread is called the "gage increment" in the Commission's Progress Report.

On the Class 4, or Close Fit, it will be remembered that a slight interference is provided for, in that the maximum pitch diameter of the screw is slightly larger than the minimum pitch diameter of the tapped hole.

Table VI — Tolerances — Coarse-Thread Series — Loose Fit (Class 1)

Figures taken from the Screw Thread Standard Report of the American Engineering Standards Committee

		SCREWS					NUTS						
1	2	3 Major Diameter	4	5 Pitch Diameter	6	7	8	9 Pitch Diameter	10	11 Minor Diameter	12	1	2
Size	Threads per Inch	Maximum (Inches)	Minimum (Inches)	Maximum (Inches)	Minimum (Inches)	Maximum Minor[2] (Inches)	Minimum Major[1] Diameter[2] (Inches)	Minimum (Inches)	Maximum (Inches)	Minimum (Inches)	Maximum (Inches)	Size	Threads per Inch
1	64	0.0723	0.0671	0.0622	0.0596	0.0531	0.0730	0.0629	0.0655	0.0561	0.0578	1	64
2	56	0.0852	0.0796	0.0736	0.0708	0.0633	0.0860	0.0744	0.0772	0.0667	0.0686	2	56
3	48	0.0981	0.9190	0.0846	0.0815	0.0725	0.0990	0.0855	0.0886	0.0764	0.0787	3	48
4	40	0.1110	0.1042	0.0948	0.0914	0.0803	0.1120	0.0958	0.0992	0.0849	0.0876	4	40
5	40	0.1240	0.1172	0.1078	0.1044	0.0933	0.1250	0.1088	0.1122	0.1979	0.1006	5	40
6	32	0.1369	0.1293	0.1166	0.1128	0.0986	0.1380	0.1177	0.1215	0.1042	0.1076	6	32
8	32	0.1629	0.1553	0.1426	0.1388	0.1246	0.1640	0.1437	0.1475	0.1302	0.1336	8	32
10	24	0.1887	0.1795	0.1616	0.1570	0.1376	0.1900	0.1629	0.1675	0.1449	0.1494	10	24
12	24	0.2147	0.2055	0.1876	0.1830	0.1636	0.2160	0.1889	0.1935	0.1709	0.1754	12	24
1/4	20	0.2485	0.2383	0.2160	0.2109	0.1872	0.2500	0.2175	0.2226	0.1959	0.2013	1/4	20
5/16	18	0.3109	0.2995	0.2748	0.2691	0.2427	0.3125	0.2764	0.2821	0.2524	0.2584	5/16	18
3/8	16	0.3732	0.3606	0.3326	0.3263	0.2965	0.3750	0.3344	0.3407	0.3073	0.3141	3/8	16
7/16	14	0.4354	0.4214	0.3890	0.3820	0.3478	0.4375	0.3911	0.3981	0.3602	0.3679	7/16	14
1/2	13	0.4978	0.4830	0.4478	0.4404	0.4034	0.5000	0.4500	0.4574	0.4167	0.4251	1/2	13
9/16	12	0.5601	0.5443	0.5060	0.4981	0.4579	0.5625	0.5084	0.5163	0.4723	0.4713	9/16	12
5/8	11	0.6224	0.6054	0.5634	0.5549	0.5109	0.6250	0.5660	0.5745	0.5266	0.5364	5/8	11
3/4	10	0.7472	0.7288	0.6822	0.6730	0.6245	0.7500	0.6850	0.6942	0.6417	0.6526	3/4	10
7/8	9	0.8719	0.8519	0.7997	0.7897	0.7356	0.8750	0.8028	0.8128	0.7547	0.7667	7/8	9
1	8	0.9966	0.9744	0.9154	0.9043	0.8432	1.0000	0.9188	0.9299	0.8647	0.8782	1	8
1 1/8	7	1.1211	1.0963	1.0283	1.0159	0.9458	1.1250	1.0322	1.0446	0.9704	0.9858	1 1/8	7
1 1/4	7	1.2461	1.2213	1.1533	1.1409	1.0708	1.250	1.1572	1.1696	1.0954	1.1108	1 1/4	7
1 3/8	6	1.4956	1.4666	1.3873	1.3728	1.2911	1.500	1.3917	1.4062	1.3196	1.3376	1 3/8	6
1 3/4	5	1.7448	1.7110	1.6149	1.5980	1.4994	1.750	1.6201	1.6370	1.5335	1.5551	1 3/4	5
2	4 1/2	1.9943	1.9575	1.8500	1.8316	1.7217	2.000	1.8557	1.8741	1.7594	1.7835	2	4 1/2
2 1/4	4 1/2	2.2443	2.2075	2.1000	2.0816	1.9717	2.250	2.1057	2.1241	2.0094	2.0335	2 1/4	4 1/2
2 1/2	4	2.4936	2.4528	2.3312	2.3108	2.1869	2.500	2.3376	2.3580	2.2294	2.2564	2 1/2	4
2 3/4	4	2.7436	2.7028	2.5812	2.5608	2.4369	2.750	2.5876	2.6080	2.4794	2.5064	2 3/4	4
3	4	2.9936	2.9528	2.8312	2.8108	2.6869	3.000	2.8376	2.8580	2.7294	2.7564	3	4

[1] Basic diameter.

[2] Dimensions given are figured to the intersection of the worn tool arc with a centerline through crest and root. Minimum flat at root equals $\frac{1}{8} \times p$.

[3] Dimensions given are allowable only with tap having theoretically sharp corners. Threaded hole must not reject correct basic "Go" gage by interference with rounded roots due to worn tap. Minimum flat at root equals $\frac{1}{24} \times p$.

This interference is calculated to about take up the "gage increment," so that in practice the maximum screw may be expected to fit snugly in the minimum hole without interference. It is, nevertheless, stated in the report that "selective assembly may be required."

It is believed that the provision of the three fits, Free, Medium and Close, will cover the major part of the requirements of industry, and that the inclusion of the Loose Fit as a recognized "special" will meet extraordinary requirements. Wrench and stud fits remain undetermined, on the grounds that further experiments are required, while varying conditions of material and thickness of section render the problem a complicated one. Something definite may be given on this subject later.

Every effort should, then, be made to confine all practice to the standard fits already given the wide variety of which fits would seem to meet all requirements. There are always, however, those engineers who want something special, and who will be setting tolerances of their own, intermediate between those specified in the standards. Fortunately there is a way of meeting their requirements without departing from the standards, and that is by "mixing the fits" in other combinations, in the same way as officially provided for obtaining the Medium Fit by mixing the Free and the Close Fits.

In Fig. 9 is a diagram showing the results of mixing all the recognized fits for the numbered sizes of threads. Class 4, Close Fit, is not regular for nuts in the numbered sizes, nor is Class 1 for screws, so that all combinations in which they are used must be classed as special. Class 4 nuts could be employed on precision work only where cost is not a prime factor.

With the Close Fit fourteen combinations are possible, covering a wide range of tolerances. Within this range are surely included all tolerances that are of practical use. If we omit those combinations which bring extremes together, such as the use of a Class I screw in a Class IV hole, we have the following combinations:

Class 1 screw in Class 1 hole
Class 1 screw in Class 2 hole
Class 2 screw in Class 1 hole
Class 2 screw in Class 2 hole
{Class 2 screw in Class 3 hole or / Class 3 screw in Class 2 hole}
{Class 3 screw in Class 4 hole or / Class 4 screw in Class 3 hole}
Class 4 screw in Class 4 hole

These nine combinations, giving seven fits evenly distributed over the whole tolerance range, will surely meet all reasonable requirements.

On this diagram the lines are so close together that it was not feasible to distinguish between combinations varying from each other by only one or two ten-thousandths of an inch. For instance, the combination of a Class 1 screw and a Class 4 nut (a somewhat unlikely

combination, by the way) is only slightly larger than that of the Class 3 screw and Class 1 nut.

The Class 2—3 combination is identical with the Class 3—2, and only slightly smaller than the Class 4—1. Class 2—4 differs from Class 4—2 only by the amount of the small negative allowance, or interference, permitted by the Class 4 screw. The same is true of the Class 3—4 and 4—3 combinations.

For the fractional sizes the conditions are as shown in Fig. 10. The same combinations may be employed as for numbered sizes, remembering that the combination of Classes 2 and 4 is officially recommended as a substitute for Class 3. As indicated on the diagram, both forms of the combination give tolerances very slightly less than the regular Class 3. All combinations on this diagram employing a Class 1 Fit are, of course, special.

One criticism made of the report is directed at the policy of setting the same tolerance on the screw as on the tapped hole, for a given fit. It is pointed out that the adjustable cutting tools used for screw threading give a much closer diameter control than can be obtained with the commercial tap, and it has been urged that this fact be recognized by giving more of the total tolerance to the tapped hole, and less to the screw. It was felt, however, that the development of the ground tap might reverse these conditions. The tolerances were, therefore, left the same for both, as averaging present and future possibilities.

By following the diagrams in Figs. 9 and 10, however, individual manufacturers who feel the situation mentioned above, and who control the production of both screw and tapped hole, can pick out combinations which recognize the difference in inherent accuracy of the two, and at the same time produce the desired final effect.

Let it be clearly understood that only one of the possible combinations, namely, that for obtaining Class 3 by mixing Classes 2 and 4, is officially recognized as standard. The others can only be used on the responsi-

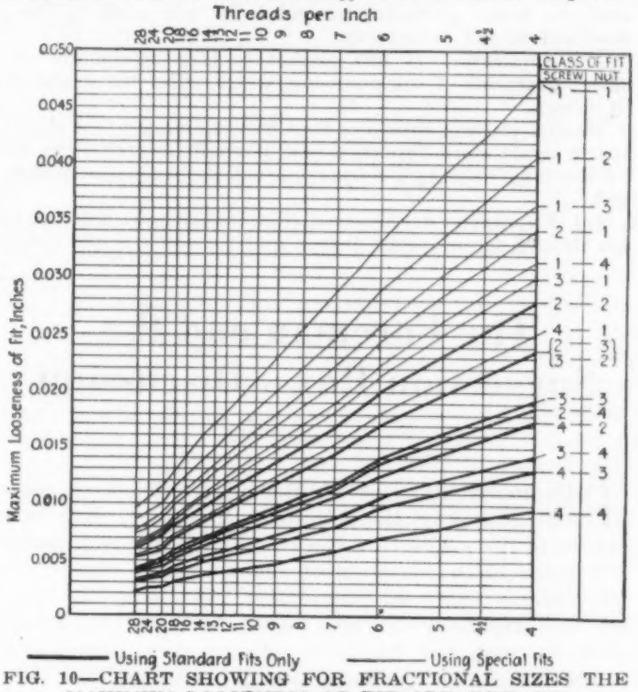


FIG. 10—CHART SHOWING FOR FRACTIONAL SIZES THE MAXIMUM LOOSENESS OF FIT OBTAINED BY MIXING SCREWS AND NUTS OF DIFFERENT CLASSES OF FIT

Table VII—Tolerances—Fine Thread Series—Loose Fit (Class 1)

Figures taken from the Screw Thread Standard Report of the American Engineering Standards Committee

		SCREWS					NUTS						
1	2	3	4	5	6	7	8	9	10	11	12	1	2
		Major Diameter		Pitch Diameter				Pitch	Diameter	Minor Diameter			
Size	Threads per Inch	Maximum (Inches)	Minimum (Inches)	Maximum (Inches)	Minimum (Inches)	Maximum Minor[2] (Inches)	Minimum Major[1] Diameter[2] (Inches)	Minimum (Inches)	Maximum (Inches)	Minimum (Inches)	Maximum (Inches)	Size	Threads per Inch
0	80	0.0593	0.0545	0.0512	0.0488	0.0440	0.0600	0.0519	0.0543	0.0465	0.0478	0	80
1	72	0.0723	0.0673	0.0633	0.0608	0.0553	0.0730	0.0640	0.0665	0.0580	0.0595	1	72
2	64	0.0853	0.0801	0.0752	0.0726	0.0661	0.0860	0.0759	0.0785	0.0691	0.0708	2	64
3	56	0.0982	0.0926	0.0866	0.0838	0.0763	0.0990	0.0874	0.0902	0.0797	0.0816	3	56
4	48	0.1111	0.1049	0.0976	0.0945	0.0855	0.1120	0.0985	0.1016	0.0894	0.0917	4	48
5	44	0.1241	0.1177	0.1093	0.1061	0.0962	0.1250	0.1102	0.1134	0.1004	0.1029	5	44
6	40	0.1370	0.1302	0.1208	0.1174	0.1063	0.1380	0.1218	0.1252	0.1109	0.1136	6	40
8	36	0.1629	0.1557	0.1449	0.1413	0.1288	0.1640	0.1460	0.1496	0.1339	0.1369	8	36
10	32	0.1889	0.1813	0.1686	0.1648	0.1506	0.1900	0.1697	0.1735	0.1562	0.1596	10	32
12	28	0.2148	0.2062	0.1916	0.1873	0.1710	0.2160	0.1928	0.1971	0.1773	0.1812	12	28
¼	28	0.2488	0.2402	0.2256	0.2213	0.2050	0.2500	0.2268	0.2311	0.2113	0.2152	¼	28
5/16	24	0.3112	0.3020	0.2841	0.2795	0.2601	0.3125	0.2854	0.2900	0.2674	0.2719	5/16	24
⅜	24	0.3737	0.3645	0.3466	0.3420	0.3226	0.3750	0.3479	0.3525	0.3299	0.3344	⅜	24
7/16	20	0.4360	0.4258	0.4035	0.3984	0.3747	0.4375	0.4050	0.4101	0.3834	0.3888	7/16	20
½	20	0.4985	0.4883	0.4660	0.4609	0.4372	0.5000	0.4675	0.4726	0.4459	0.4513	½	20
9/16	18	0.5609	0.5495	0.5248	0.5191	0.4927	0.5625	0.5264	0.5321	0.5024	0.5084	9/16	18
⅝	18	0.6234	0.6120	0.5873	0.5816	0.5552	0.6250	0.5889	0.5946	0.5649	0.5709	⅝	18
¾	16	0.7482	0.7356	0.7076	0.7013	0.6715	0.7500	0.7094	0.7157	0.6823	0.6891	¾	16
⅞	14	0.8729	0.8589	0.8265	0.8195	0.7853	0.8750	0.8286	0.8356	0.7977	0.8054	⅞	14
1	14	0.9979	0.9839	0.9515	0.9445	0.9103	1.0000	0.9536	0.9606	0.9227	0.9304	1	14
1⅛	12	1.1226	1.1068	1.0685	1.0606	1.0204	1.1250	1.0709	1.0788	1.0348	1.0438	1⅛	12
1¼	12	1.2476	1.2318	1.1935	1.1856	1.1454	1.2500	1.1959	1.2038	1.1598	1.1688	1¼	12
1⅜	12	1.4976	1.4818	1.4435	1.4356	1.3954	1.5000	1.4459	1.4538	1.4098	1.4188	1⅜	12

[1] Basic diameter.

[2] Dimensions given are figured to the intersection of the worn tool arc with a centerline through crest and root. Minimum flat at root equals $\frac{1}{8} \times p$.

[3] Dimensions given are allowable only with tap having theoretically sharp corners. Threaded hole must not reject correct basic "Go" gage by interference with rounded roots due to worn tap. Minimum flat at root equals $\frac{1}{24} \times p$.

bility of the individual manufacturer to meet his own real or fancied *special* conditions.

The following paragraphs cover the references in the Report to special diameters and pitches:

(b) *Special Pitch and Diameter Combinations*—In general the tables given are intended for use with the two standard thread series only.

The application of fine pitches to large diameters involves questions of workmanship, which affect the grade of fit chosen.

When a pitch of thread is used with a diameter not called for in a standard thread series, it shall be defined as of "American (National) Form," but not as "American Standard."

(c) *Tolerances for Special Pitches*—Where tolerances are desired for a special thread and the pitch is not listed in the tables given, the tolerance values should be chosen corresponding to the number of threads per inch nearest to that of the special thread being produced. Where the number of threads per inch is midway between two of the pitches listed, the tolerance corresponding to the coarser pitch should be used. For instance, the tolerance on a screw having 11½ threads per inch would correspond to the tolerance specified for a thread of 11 threads per inch.

Major Earle Buckingham of the Commission is working on a scientific method of determining tolerances for special diameters and pitches, taking into account also the effects of length of engagement and quality of fit desired. These factors are combined for any pitch and diameter in a simple and logical way, and it is hoped that his suggestions will soon be ready for publication.

The Foreman and the Suggestion Box—Discussion

By J. E. Powell
Bexley Heath, Kent, England

THE contribution of W. Roland Needham on page 208, Vol. 59 of the *American Machinist*, with reference to the suggestion box caught my eye and, being interested in the question of suggestions, I venture to forward my views on this matter. Mr. Needham hits the nail right on the head when he says that much depends upon the mentality of the men themselves, foremen included. I would submit, however, that it is necessary to go further, and suggest that the term "men" must also include the management. What line does the management take over the matter? There is a big human question behind all this and the managements themselves can be held largely responsible for the answer.

It is all Mr. Needham says—a question of mentality and imagination—and the firm which gets these two factors right and keeps them right will find it good business. But that is just the problem. There is no doubt that putting forward suggestions has gotten many men fired, either for putting forward suggestions at all or because the suggestions were really good. The writer, as a workman, has personally experienced the dangers of making suggestions and his fear of the results is the fear of many workmen today.

This Suggestion Proved a Boomerang

On one occasion solely to find out what would befall the author of a suggestion I sent one forward under a nom de plume. The suggestion was accepted and the management posted a note on the departmental notice board asking for the identity of the successful man. Emulating Brer Rabbit, however, I lay low and, not long after, became the unsought confidante of the foreman's clerk who was specially commissioned to find out quietly who the individual was. When found out, he was to be "Johnnie Walker." I did not disclose my identity, nor did I take another risk.

On the other hand I have seen that the risk can be as real to the foreman as to the workman. It is true that a small minded foreman is capable of firing a workman because the man's suggestions indicate that his brains and knowledge are equal to or superior to the foreman's own, and to lose such a foreman would not be a great loss, provided there were no other grounds for the action taken. But there's the rub; what line does the management take? Suppose a foreman encourages workmen to send in suggestions, and they do—I have had foremen bring them to me personally—does the management feel disposed to think a suggestion by a workman is a reflection on the foreman's ability, that what the workman has seen the foreman ought to have seen? How would they consider a foreman from whose department a greater proportion of good suggestions were sent than from any other? Would it suggest to them that he was not so good as the men he supervised, or alternatively that he was so good a man himself that he could get good men to work for him? All the brains in the world are not to be found under one hat and this is a fact which ought to be kept in mind. In some works the evidence is that altogether the wrong view is taken by the management, and workmen's suggestions have been used to flog the foreman.

The Foreman and the Management

Foremanship is becoming more a question of man management than ever, and that foreman will be most successful who can not only get the best men to work for him, but can also get them to do their best. It is not inconceivable that many suggestions could emanate from a department where such a foreman was in control and, if the managers were as big men as their foreman and the "foreman's workmen," a suggestion scheme would probably be a success. If they were not, however, the foreman would take his cue from his short-sighted superiors and in self-defence would discourage the making of suggestions. The suggestion scheme would fail, killed by the management.

For a suggestion scheme to be truly effective broad views are necessary. There can be no doubt that many suggestions can be made from a department where the ability of a foreman is low, but it is a misuse of the suggestion scheme if the management uses it to ascertain this fact. If it knows its business, it will find this out without seeking the aid of the workmen in this manner. The managers should first satisfy themselves that their choice of foremen is right and then do all in their power to encourage suggestions by payments, appropriate in amount, freely although not carelessly given. They would do well to congratulate the foremen from whose departments good suggestions were received. One great advantage both to workmen and management which can arise from a successful suggestion scheme is the opportunity for talent and brains to express themselves and from the ranks of "suggesters" can be recruited the future staff.

What Ford Has Done in the Lincoln Plant

BY FRED H. COLVIN
Editor, *American Machinist*

Assembling and inspecting Lincoln motor parts—Honing cylinders and polishing gear teeth—Keeping the camshaft straight—Fixtures for assembling and gaging piston alignment—Second article

WHILE it is not to be expected that the methods developed in any one shop will differ in every respect from all others, it is instructive to note some of the smaller details which are being used in producing a thoroughly high-grade car.

The problem of finishing cylinder bores is always a subject for discussion among automotive engineers. Before the general use of the cylinder grinder, the combination of boring, reaming, and lapping was supposed to be the last word in cylinder finishing. Then lapping gradually gave way to grinding, and different grinding men, as well as car builders, vied with each other in the perfection of cylinder bores, that should be as round as possible, should not vary appreciably in diameter, and should have a mirror-like finish. There is, however, a tendency at the present time not only to grind as good a hole as possible, but to supplement the grinding with a light lapping or honing process. This is the practice in both the Lincoln and the Rolls-Royce plants.

The Lincoln engineers have developed the honing machine shown in Fig. 11, especially for handling the complete cylinder block at one operation. There are four hones in each cylinder, all being carefully turned to the proper radius and held against the cylinder walls by light springs. The hones are of No. 180 carborundum and travel up and down 110 strokes per min. and at the same time they are revolved at the top and bottom of each stroke by an abrupt unequally spaced ratchet so as to make one complete revolution per minute. The hones thus assume different paths at each stroke. Each hone is liberally supplied with kerosene from the pipe shown just behind it. The hones have the same stroke as the piston in the cylinder, 5 in., and are allowed to make two complete revolutions, which occupy two minutes. The amount of metal removed is hardly appreciable, but the hones impart a finish to the cylinder walls which is not only pleasing to the eye but is giving excellent results in service.

KEEPING CAMSHAFTS STRAIGHT IN HARDENING

Another special device which has just been put in operation is shown in Fig. 12. This is for holding camshafts straight and true during the hardening process, and so eliminates practically all spring or distortion, which is so common in long shafts of this kind. When a camshaft is withdrawn from the heated furnace, it is quickly placed in the vertical position in the hardening machine, as shown at *A*, where it rests against two sets of supporting rollers, as at *B* and *C*. Then, the substantial frame *D*, which also carries six rollers, is swung in front of the camshaft, locked in position, and power applied to one of the roller shafts by the motor on top of the hardening machine. At the same time, the cooling-water supply is turned on and a large volume of water from three vertical pipes immediately floods the whole shaft and cools it quickly. Some of the spray nozzles are shown at *E*. In this manner the camshaft is held against excessive springing during the cooling, which saves considerable time in straightening after hardening.

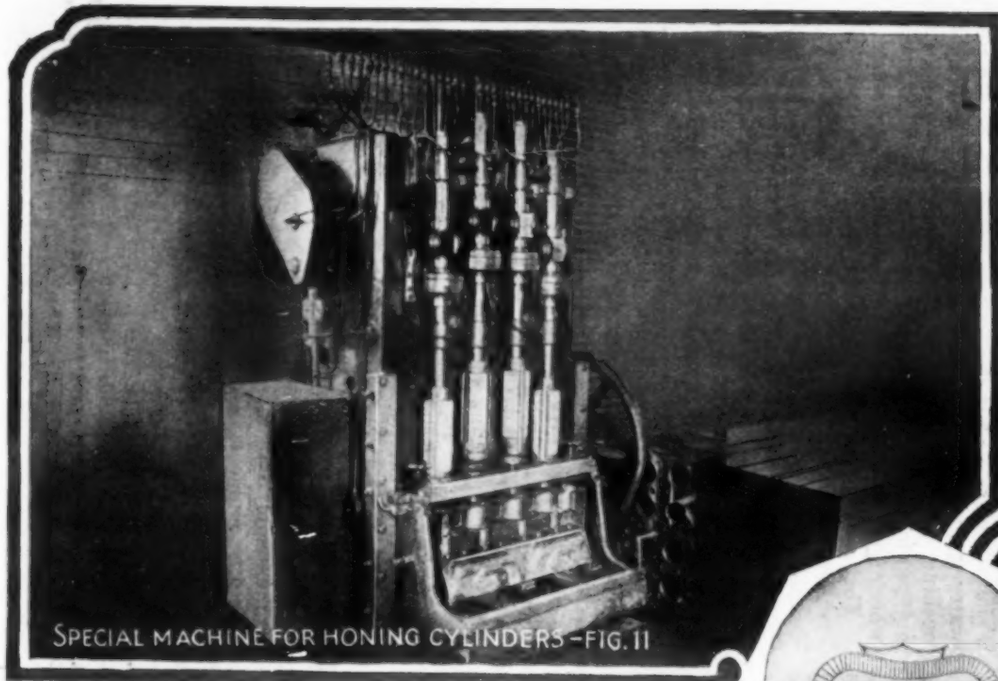
DETAILS OF THE FIXTURE

The supporting and driving rollers are knurled and grip the camshaft firmly in order to insure its being revolved at approximately 110 r.p.m. The sliding door *F* is, of course, closed in front of the work before the water is turned on. The camshaft laid in front of the opening shows the four large bearings which are gripped by the smaller rollers, while the larger knurled wheels grip the ends which are of smaller diameter.

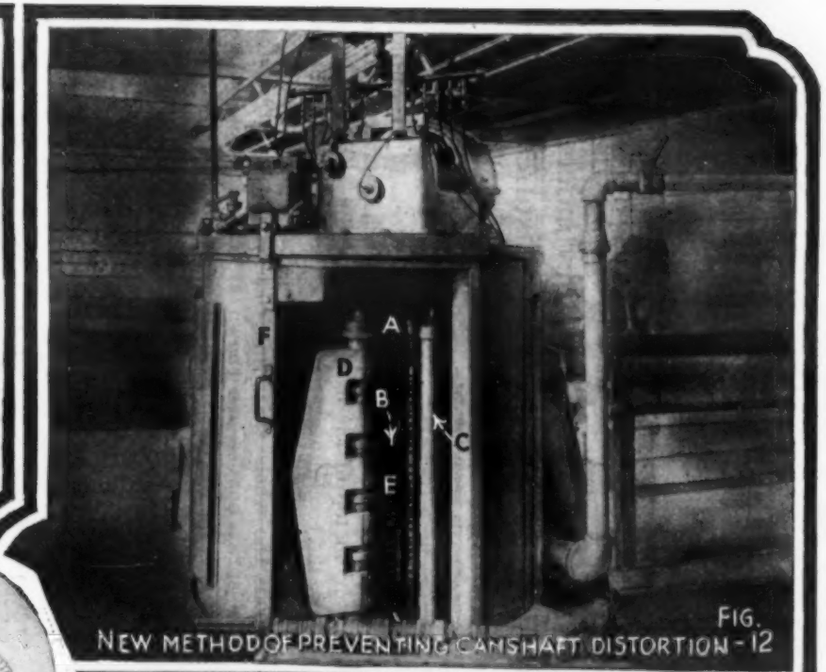
For testing the alignment of the piston and the crankshaft bearing at the other end of the rod, the device shown in Fig. 13 is used. The bearing end of the rod is slipped over the mandrel *A*, which represents a crankpin. The second rod is supported by the pin *B*. Then the clamp *C* is placed over the bolt-heads of the rod being tested (the single rod in this case), with the end of the lever *D* inside the clamp. Pressure is then applied to the other end of the lever by means of a screw operated by the handle *E*, until the slack has been taken up between the two rods. This slack, of course, is only the necessary allowance for the lubricating oil film, which is approximately 0.0015 in., but this slack is taken up in order that the alignment of the piston and the crankpin bearing may be as nearly exact as it is possible to make it.

The piston rests on the steel angle plate *F*, the back side of which carries a floating straight-edge at *G*. The straight-edge is connected to the dial indicator shown and tells exactly how much the piston deviates from exact alignment, if any. The double or spade rod is also tested on the same fixture by simply reversing the rod assembly. In this case, however, the clamp *H*, having the double rings to reach all four bolt-heads, is used in place of clamp *C*.

The method of holding the piston pin in the piston is unusual, and the device for putting the locking pin in place is of interest. The locking pin is straight and is made from stock selected to a 0.0005-in. limit. It has rounded ends, and is casehardened. Some of the

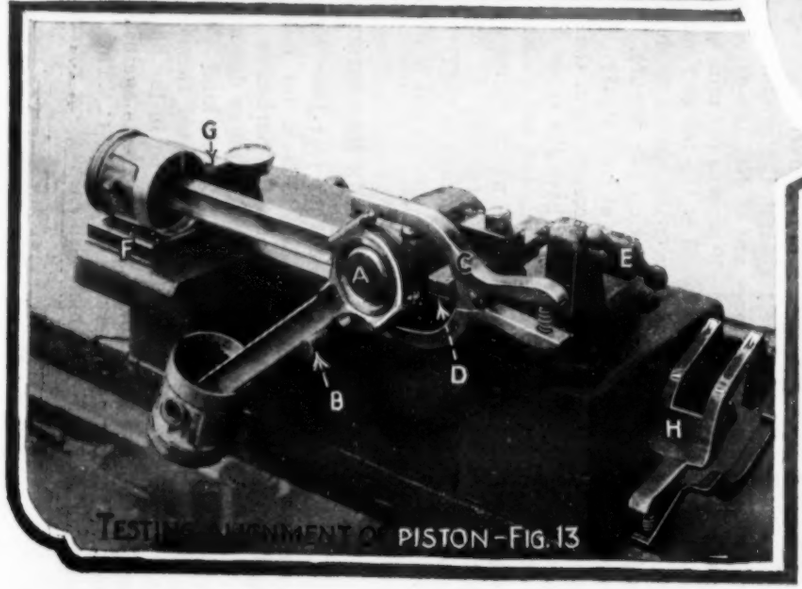


SPECIAL MACHINE FOR HONING CYLINDERS—FIG. 11

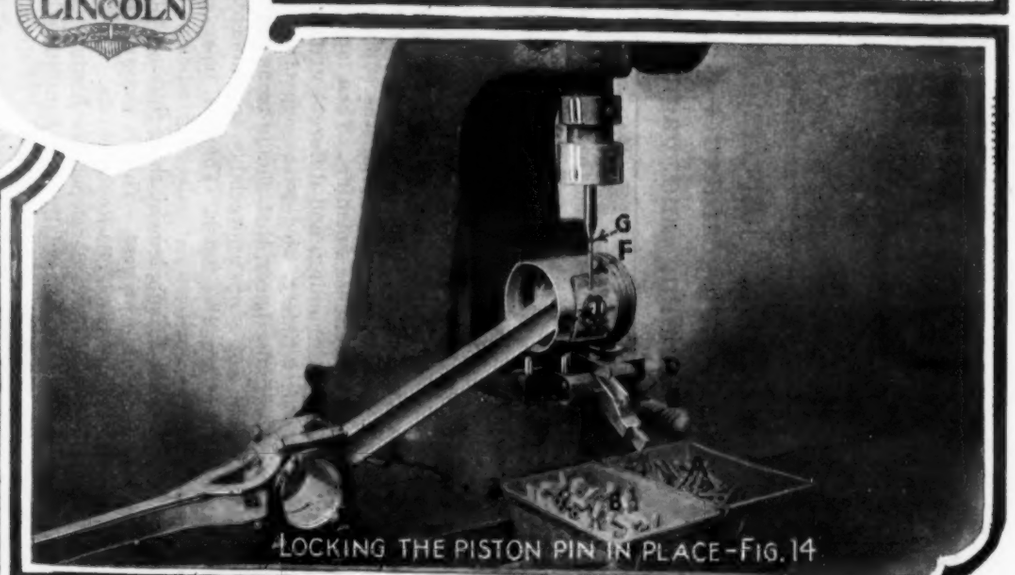


NEW METHOD OF PREVENTING CAMSHAFT DISTORTION—FIG. 12

LINCOLN



TESTING ALIGNMENT OF PISTON—FIG. 13



LOCKING THE PISTON PIN IN PLACE—FIG. 14

pins can be seen in Fig. 14, at *A*. The close-diameter size is maintained in order to insure a proper fit in the piston bosses. The locking device is a steel sleeve, slit, some of which are shown in the pen at *B*. The sleeve is not heat treated but is made of hard-drawn material of suitable analysis. The hole in the sleeve being maintained to 0.002-in. limit, is enough smaller than the diameter of the pin, so that when the pin is forced in place through the piston boss, the piston pin, and the locking sleeve, the tension of the sleeve on the pin is sufficient to prevent the possibility of its ever coming loose in service.

How the Locking Pin Is Inserted

In order to insert the locking pin quickly, the assembled rod, piston, and piston pin are placed in the fixture shown in Fig. 14. The hollow piston pin is slipped over the stud *C*, one of the split sleeves inserted in the notch in the end of *C*, and the arm *D* swung up with the left hand, so that the pin *E* pushes the split sleeve into position against the bottom of the slot and brings it in line with the locking pin holes. A locking pin is placed in position, as at *F*, and the right hand of the operator forces down the plunger *G*, which pushes the pin into position through both sides of the piston boss and piston pin, and through the locking sleeve. This operation is performed in much less time than it takes to describe it and forms an excellent locking device which can be readily removed when occasion requires, without damage.

The method of testing the play or oil-film allowance of the plain or single connecting rods at final assembly is shown in Fig. 16. Here the rods are all in place on the crankshaft in a completely assembled engine, which is shown turned upside down on its assembly stand. The frame of the testing device is fastened to two of the bolts in the double connecting rod, as shown at *A* and *B*. At the upper end of the gage frame is the dial indicator *C*. Between the two uprights of the gage is an arm that rests on the single rod which is between the other two ends of the forked rod. With the steel bar *D* hooked under the middle bolt-head, the operator takes up the slack or play due to oil allowance in the bearing. In this way, it is definitely known that there is a sufficient oil film space in every bearing. The allowance for oil film between the crankpin bearing in the forked rod and the crankpin, is tested in a similar manner. After the assembled engine has been run under its own power on test, these bearings are all removed, inspected, the engine reassembled and the bearings tested as above described.

A Convenient Device

A very convenient assembling device for putting the pin in the valve-slide roller is shown in Fig. 17. One of the slides with the adjusting screw at the top is shown at *A*, and a roller is in position at *B*, ready to be lowered, so that its hole comes in line with the pin *C*. Moving lever *D* to the left lowers the roller to its proper position, and with the slides *A* dropped over the roller, a movement of the lever *E* forces the rack-driven plunger *F* to the left. This pushes the pin *C* in position with its rectangular head vertical, ready to slide in the slot of the guide bushing, and prevents the guide from turning as it travels up and down under action of the cam. Plunger *G* ejects the pin should it be pushed in without the guide in position.

A very unusual method of putting piston rings in their respective grooves is shown in Fig. 18, and the details in Fig. 15. The device consists of a base plate and three heavy steel tubes, the nominal outside diameter of which is approximately the same as that of the inside diameter of the piston ring. The upper ends of these tubes are enlarged, as shown at *A*, Fig. 15, and short sections of thin tubing are fastened to them, the inside diameter of which is slightly larger than the outside diameter of the piston, as shown by the black line *B*. The lower edge and outside diameter of this outside tube merge into the shape of the heavy tube itself which has a tapered portion that expands the rings and allows them to slide up over it as the tube is pushed down. The tubes are then loaded with piston rings from the small end, as shown in Fig. 18, and the ends of the tubes inserted in the base plate. The three tubes are alike, except for the length of the thin tube at the upper end, the long tube being shown at the left

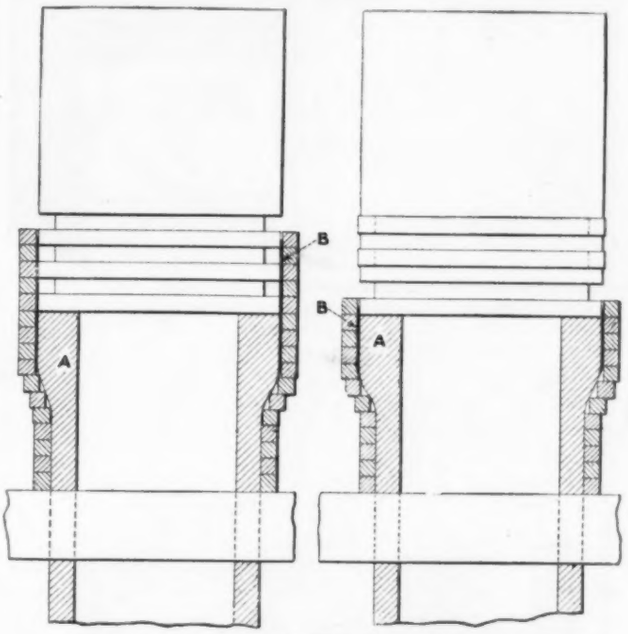
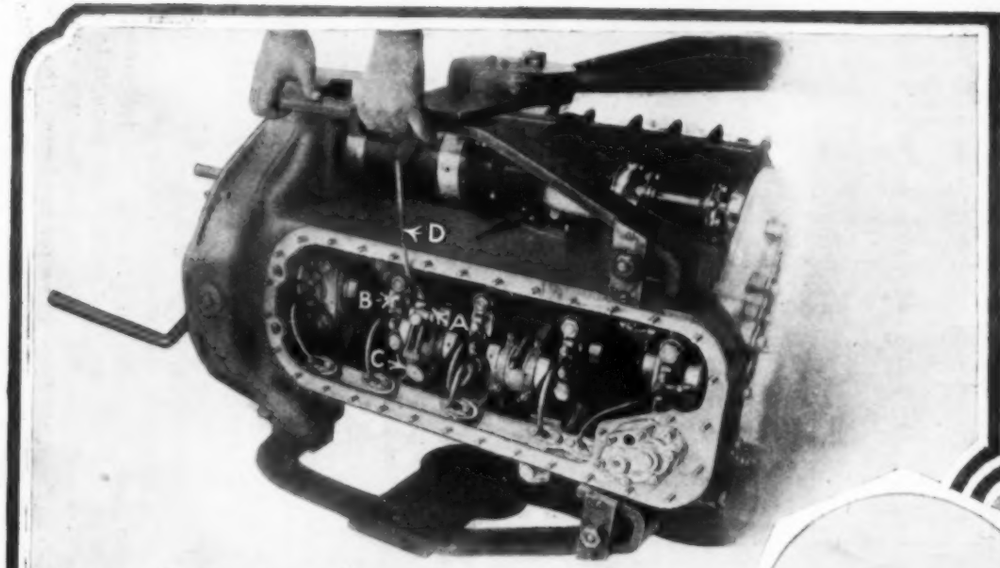


FIG. 15—DETAILS OF PISTON RING DEVICE

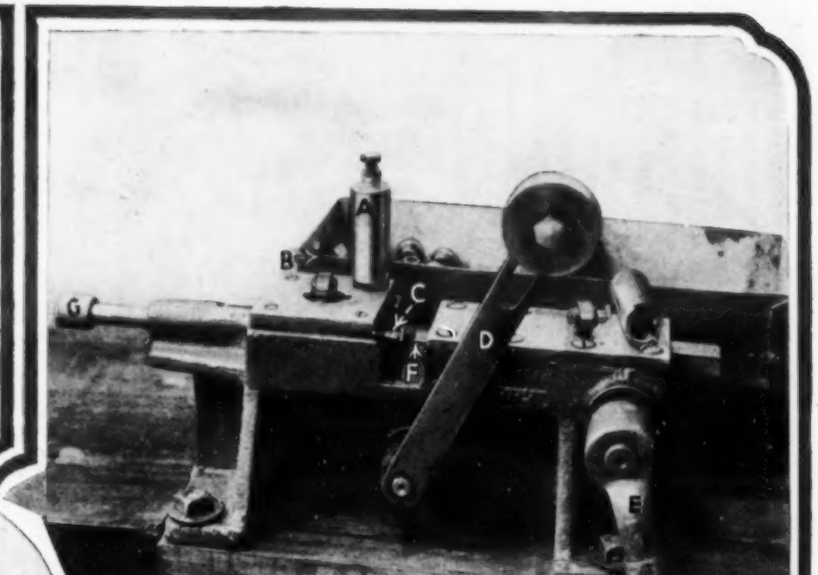
and the short tube at the right of both Figs. 18 and 15. The length of these thin tubes is proportioned in accordance with the spacing of the grooves in the piston, as each tube delivers rings to a definite groove in the piston.

Beginning at *A*, Fig. 18, a piston is inserted head down inside the thin tube which projects from the heavy tube, as shown in Fig. 15. By pushing down on the piston the tube inside the ring is forced down through the base plate, and the upper ring is pushed off the top of the thin tube just as the upper groove in the piston comes even with the ring which is released. The ring snaps into the groove and the piston is then inserted in the middle tube to receive the second ring. The top ring is then put on as shown in Fig. 15 at the right.

Another refinement, in the endeavor to secure the utmost of quietness and smooth running of the transmission gears, is shown in Fig. 19. The teeth of the soft gears are burnished by rolling just enough to remove any roughness from the cutting, but not enough to change the tooth form and after hardening, the teeth are polished on the machine shown in Fig. 19. This



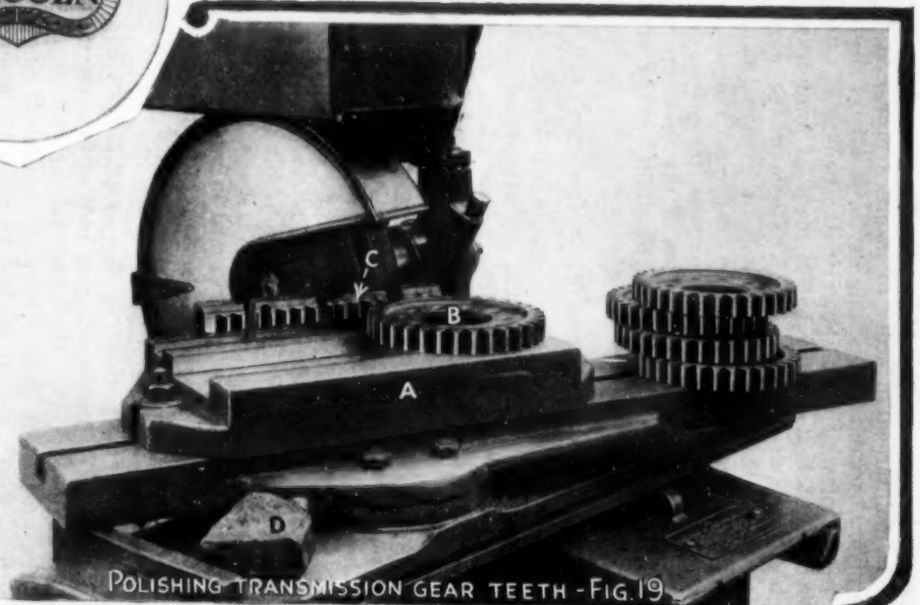
MEASURING OIL FILM ALLOWANCE ON CONNECTING RODS - FIG. 16



ASSEMBLING CAM ROLLER IN SLIDE - FIG. 17

LINCOLN

PUTTING RINGS IN PISTON GROOVES - FIG. 18



POLISHING TRANSMISSION GEAR TEETH - FIG. 19

process may perhaps be likened to the honing of the cylinders after they have been beautifully ground on a Heald machine.

In order that the polishing process may not in any way alter the tooth form, the gears to be polished are rolled past the polishing wheel so that the teeth pass in a generated path and the correct contour is maintained. The table *A* is swung to the pressure angle of the gear, and the gear laid on the top of the table, as at *B*, so as to mesh in the rack *C*. The rack is provided with suitable openings through which the polishing wheel can reach the face of the gear tooth. The gear is then simply rolled along the rack past the side of the polishing wheel and receives a high polish. A thin elastic wheel of very fine grain is used which in reality only forms the base or carrier for the polishing material that is applied to its sides. A combination of tripoli and tallow in the form of a cake is used as shown at *D*, and applied to the sides of the wheel from time to time. A beautifully polished surface results from the operation.

Mercury Boiler Promises Economies in Power Developments

A DOUBLE vapor power plant in which turbines for generating electricity are driven both by mercury vapor and water vapor from the same fuel source, with a gain of about 50 per cent in power over present methods, is the outstanding achievement of a new boiler developed by the General Electric Co., Schenectady, N. Y. Two such boilers have been built to date, an experimental apparatus operated at the Schenectady works and an installation now under observation at the Dutch Point station of the Hartford Electric Light Co. at Hartford, Conn.

This installation is the first of its kind in the world although experiments have been conducted by the General Electric Co. over a period of several years. The success of these preliminary experiments warranted the construction of a set of commercial size and it was arranged between the two companies that this installation should be made in Hartford. The equipment is now being operated under a partial load for the purpose of getting further experience in the operation of the system.

The process is novel in every particular, and it was necessary to study the characteristics of mercury and its vapor carefully and on an elaborate scale. During the earlier experiments it was found that no form of packing or calking for the joints of the apparatus would resist the mercury vapor, and the development of electric and acetylene welding has made such apparatus possible.

Development of Apparatus and Process

Since there was no precedent by which to work, it was necessary not only to design and manufacture the apparatus, but also to devise methods of operation. The process involves the vaporization of the mercury in a boiler, the driving of a turbine by the mercury vapor, and the condensation of the exhaust in a condenser, where its latent heat is delivered to water. This action generates steam at a pressure suitable for use in existing steam plants.

The condensed mercury runs back to the boiler by gravity, and the mercury vapor therefore acts as a heat conveyor as well as furnishing power for its turbine. A means is thus provided by which the temperature range of operation is more than doubled as compared with steam processes, and the efficiency is consequently greatly increased. A steam superheater and a feed water heater are used to reduce the temperature of the flue gases to usual steam plant values.

Mercury boils and condenses much like water, except that its density is much greater and its boiling temperature much higher. At atmospheric pressure mercury boils at 677 degrees F. and water at 212 degrees. Mercury condenses in a 28-in. vacuum at 455 degrees F. and water at 100 degrees.

At present mercury sells for about 80 cents a pound and the boiler installed in Hartford contains 30,000 pounds. It is designed to give from mercury and steam about 4,100 kw., which is about 7.3 lb. of mercury per kw., but recent experiments indicate that in future designs 4 lb. per kw. will be sufficient.

The original application of this process on a considerable scale was built at Schenectady and operated experimentally on many occasions, but, although it was designed to deliver 1,500 kw. from the mercury turbine, it was never run at a load exceeding 1,050 kw. Of this power 800 kw. constitutes net gain as compared with a 200-lb. steam process, operating under similar firing conditions. With the steam produced in the process used as in the best power stations, this result is equivalent to about 11,300 B.t.u. per kw.-hr., while 18,000 B.t.u. per kw.-hr. is considered extremely good in existing steam plants.

The question which naturally arises in connection with the process is raised by the danger from mercurial poisoning, either to the community or to the attendants. As previously stated, all the joints are welded, so that it is impossible for the mercury to escape except through accident, and arrangements are made so that any leakage which may occur will go into the stack where it will do no harm.

W. L. R. Emmet, consulting engineer of the General Electric Co. and inventor of the mercury process, estimates that if the mercury boiler comes up to all expectations, it will produce at 35 lb. per sq.in. gage pressure, 52 per cent more output in electricity per pound of fuel than a steam turbine plant using steam at 200 pounds pressure. Mr. Emmet has had an important part in the designing of electrical apparatus for the company and in the development of its uses from the time of the company's formation. Among the more important developments for which he has been responsible are the Curtis turbine and electric ship propulsion.

Small Milling Cutter Data

I recently saw an interesting job in a special milling machine, a spiral groove being cut in a small shaft. Several cuts were made and the cutter was fed into the shaft by a very slow cam in increments of half a thousandth of an inch (0.0005) at each end of the groove. The cutter was an end mill having four cutting lips, and only forty thousandths of an inch (0.040) in diameter. The depth of cut was determined by experience, and the half-thousandth was found to be all that the cutter could be depended upon to stand, even when flooded with oil.

Getting the Safety Idea Over

By J. E. Bullard

WHEN an investigation was made through questionnaires and interviews to determine the attitude of manufacturers, machine shop men and the like, toward a certain safety article designed for the workman to wear, answers indicating reactions all the way from the greatest pessimism to the greatest optimism were given. Some men replied that you couldn't get the workmen to wear anything that would promote their safety, that they would rather take a chance. Others replied that they were having great success and gave figures showing to what an extent the accidents had been reduced.

The man who was able to keep up enthusiasm got results. The man who was not able to keep up enthusiasm did not get results. The man who tried to force his men to wear these things did not always succeed. The man who taught them and got them really enthusiastic about these articles, who used posters in his plant and left nothing undone to drive home their great value, did get results.

There is, however a class of men who always seem to want to take a chance. A little analysis of the character of these men will reveal the fact that the motive back of it all is usually the desire to attract attention. They have a hunger for notoriety, and often the only way to get these men to take a real interest in the safety idea is to feed this desire for notoriety to the fullest extent.

When photographs are taken of accidents and posted as horrible examples, there is always danger that this practice will actually encourage the notoriety seekers to expose themselves to accidents. In that way they will be brought to the attention of everyone in the shop. Therefore, where there are a large number of men working, calling too much attention to the accidents that have taken place may bring, at least in the case of some individuals, just the opposite of the desired result.

The Desire for Publicity

In the breast of nearly every human being there is a desire for fame, a desire to attract to themselves the attention of their fellow men. In every shop where there are many men employed there will be found some who have this trait of character more or less prominently developed, and if the accidents in that shop are to be reduced to the minimum, the psychology of these men will have to be considered. If the accidents they meet with gain any great amount of publicity, if the attention of everyone in the shop is called to them, if news of them gets into the papers, it is then going to be extremely hard to keep these notoriety-seeking men from taking chances.

Because of all this it may be necessary to give more publicity to the lack of accidents than to the accidents themselves in order to get the safety idea over with greater effect. This can be done in various ways. Employees who have been in the employ of the company for a certain length of time without having an accident of any kind may be given a medal, in the form of a button or other insignia that can be worn at all times. If this can be presented in a public way and the presentation be given a great deal of publicity, so much the better. If the company publishes an employee's magazine, the names and the pictures of these men together with something about them should appear in the pages of the magazine. In this way that innate desire for fame is in a measure satisfied, and many a person who would never be careful under any other circumstances will do all in his power to avoid accidents, in order that he too may acquire that modicum of fame.

Contests can be conducted between different departments, and possibly between different groups in the same department, for the reduction of accidents, some honor that means publicity being conferred on the department that wins the contest. And right in this connection it is well to bear in mind that, as a rule, a contest of any kind is not at all likely to get the best results unless a great deal of the right kind of publicity can be given to it.

The Contest Should Be Advertised

If you want a really good and a really exciting contest, you simply have to give it a lot of publicity, you have to get a lot of people to watch it, and you have to attract a lot of attention to the contestants. Do this and the contest becomes spirited. Announce a contest and give it no publicity, just let the contestants compete with each other, don't tell anyone else about it, don't even let the contestants know where they are standing until the end of the race, and it is all bound to fall flat. Little, if anything, is accomplished.

The winning of a prize isn't what counts, even if the prize is really substantial, so much as the publicity that is connected with the winning of that prize. These are facts that must be borne in mind if any contest is to be made the success it should be. Everyone who may be at all interested must be given the news of the contest, they must be kept informed. Then some really interesting results may be anticipated.

Therefore, if a safety first contest is to be conducted, just as loud a noise about it and its progress must be made as it is possible to make. If you want a man to avoid accidents, it is wise to give just as much attention as possible to the man who doesn't have accidents because he is careful.

There are of course exceptions to this but not so many as one is sometimes led to believe. There are very few people who do not desire fame and a great amount of publicity, but the number is certainly exceedingly small. Usually where it seems to be a case of not desiring the notice, it is really more a fear that the notice may be ridicule rather than praise, that it means disparagement rather than respect. There is probably not a person in the world who is not hungry for and who does not greatly appreciate real praise and respect.

Accomplishments Should Be Praised

This means that when publicity is given to any man, it is wise to make that publicity breathe a spirit of praise and respect. When this is done, the only danger is that it will be overdone to the extent that it will become ridiculous.

The time has come in many fields when it is better to make more noise about the good things and less noise about the bad. Play up the lack of accidents and the success with which they are being prevented, with less stress on the accidents that are actually happening, and among a certain class of people the number of accidents are almost always certain to decrease. The rest of the people are the kind most likely to be careful anyhow.

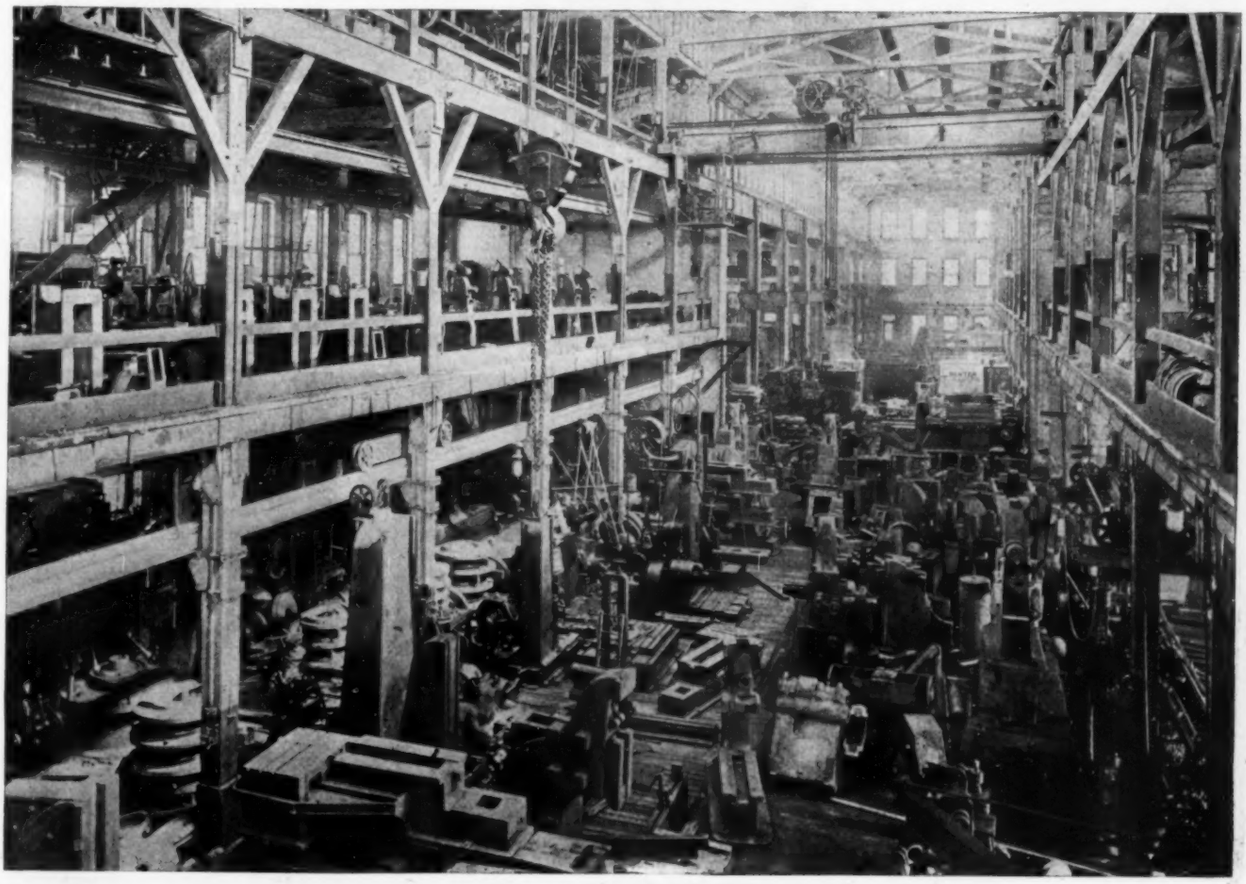
Where Machine Tools Are Made

Consolidated Machine Tool Corporation of America

Rochester, N. Y.

Newton Works

Founded 1874



How the Hendey Shop

Special Machines

Fig. 1—Planing a string of lathe beds on a Gray planer.

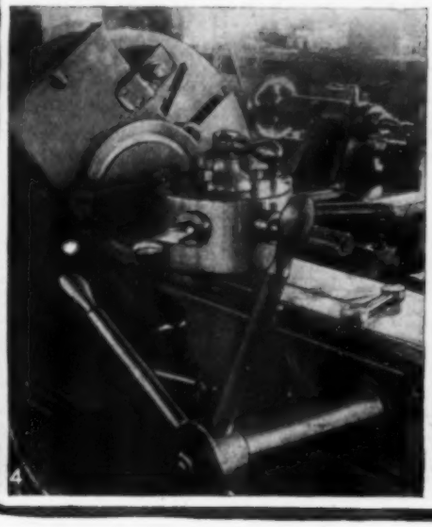
Fig. 2—Another lathe bed planing operation on Chandler planer.

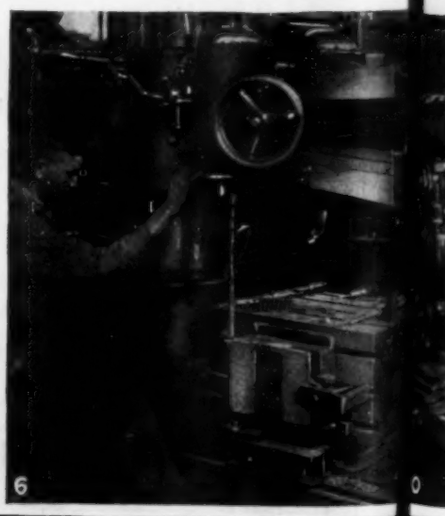
Fig. 3—Boring spindle and back-gear shaft holes in headstock. Special machine for each size headstock.

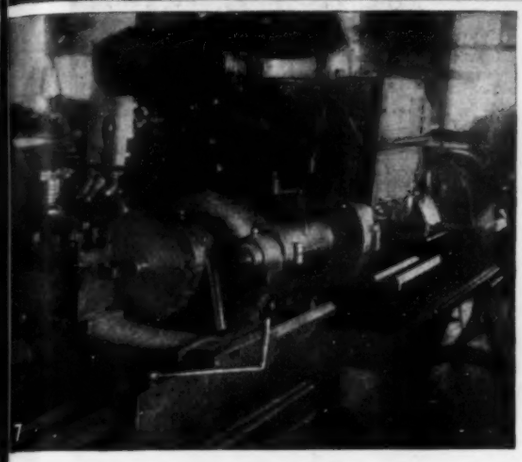
Fig. 4—Turning circular T-slot in base of compound rest.

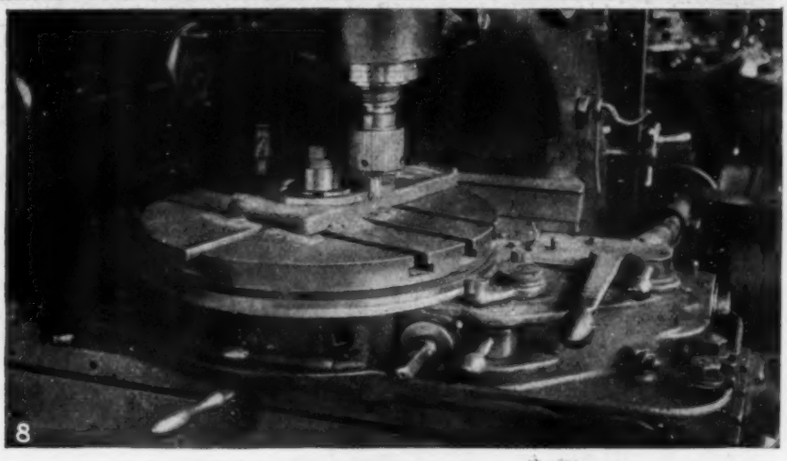
Fig. 5—Trunnion drilling fixture for carriage apron. All holes drilled at one setting. Cincinnati Bickford drilling machine.

Fig. 6—Drilling and reaming hinge bolt hole in motion platform.









Builds Engine Lathes

and Operations

Fig. 7—Facing bottom of compound slide in a Hendey motor-driven lathe.

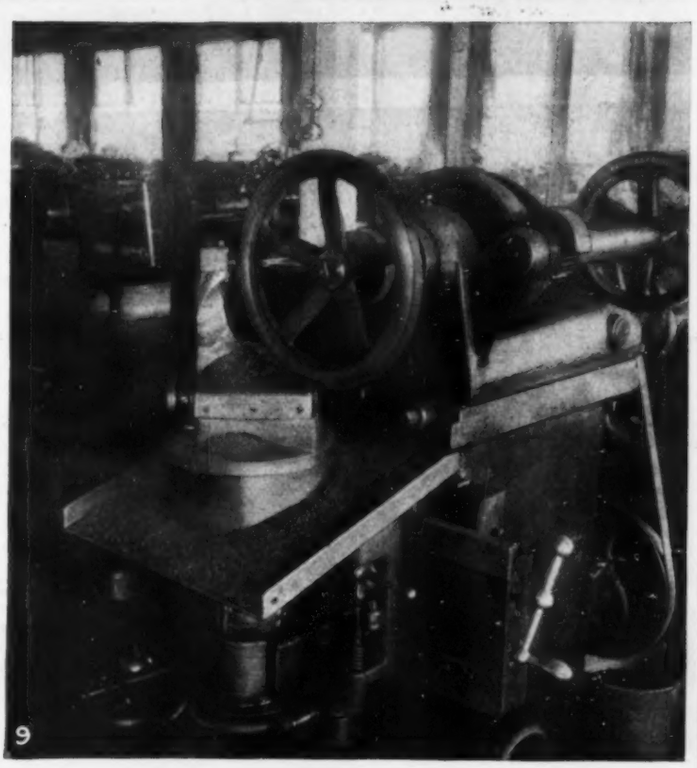
Fig. 8—Milling the base of the compound slide in a Becker vertical-spindle machine.

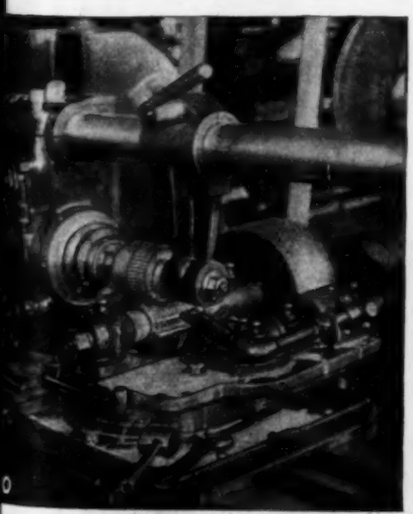
Fig. 9—Turning rim of hand wheel. Machine built from pillar of Hendey shaper and headstock from a lathe.

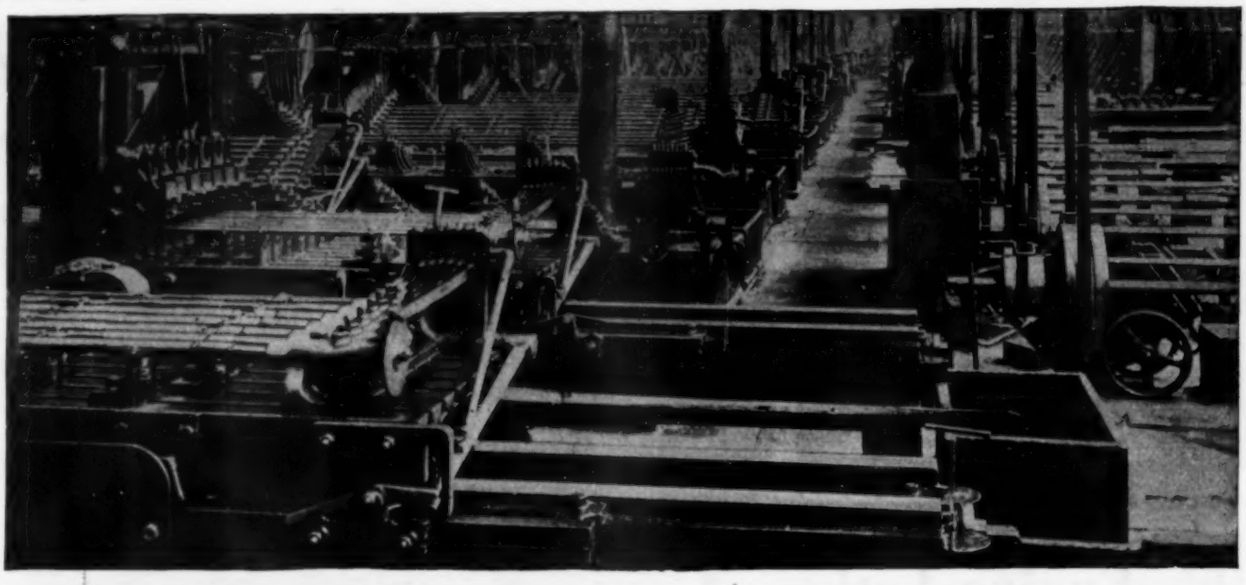
Fig. 10—Hobbing worm gear for lathe-carriage feed on Colburn gear hobber.

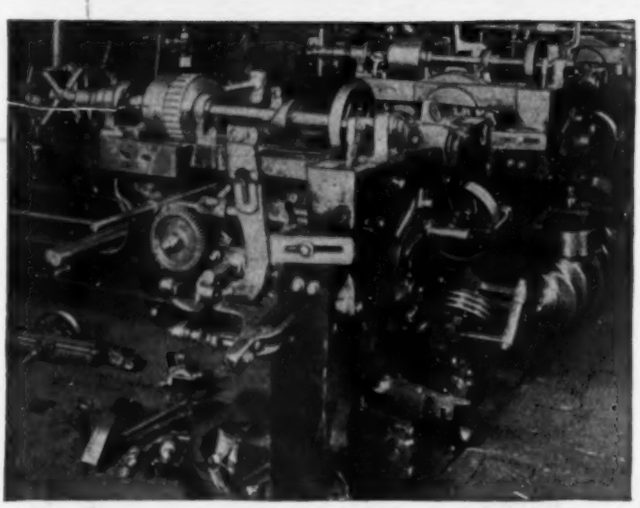
Fig. 11—Cutting the change gears in a Fellows high-speed gear shaper.

Fig. 12—Cutting multiple thread worm. Tool is hardened worm with cutting edge set below center.





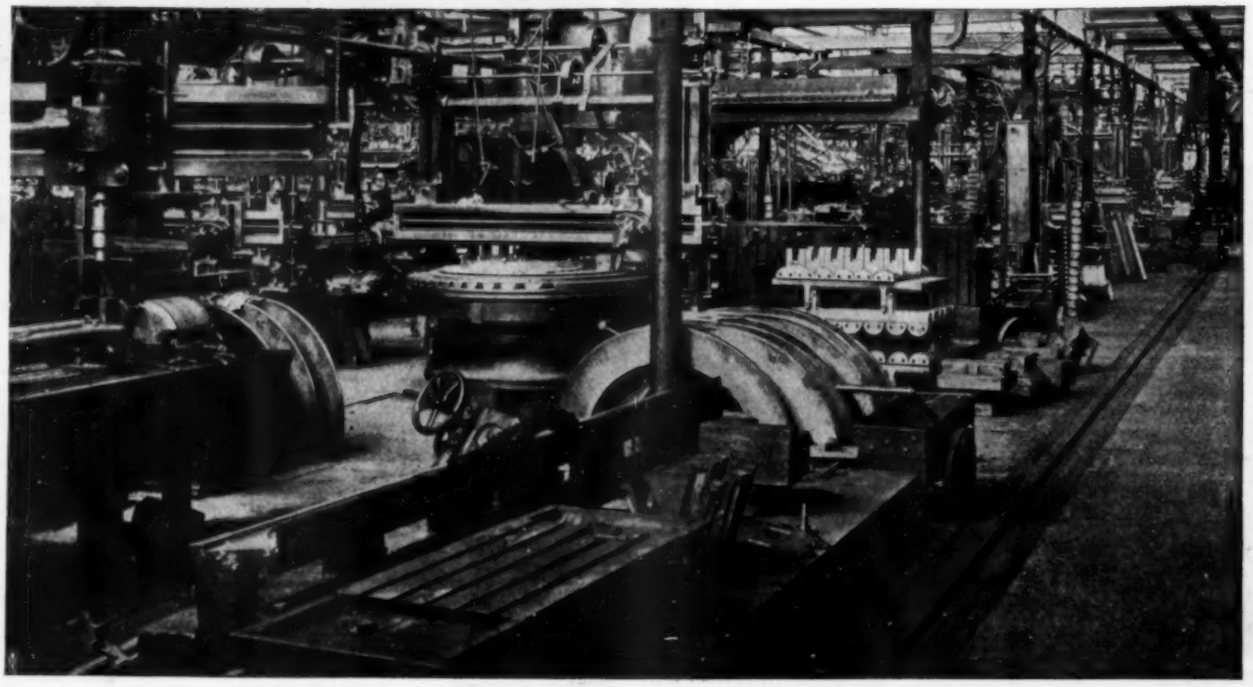




In a British Textile Machine Shop

Platt Brothers & Co., Ltd.
Oldham, England

Above—Planing Bottom Rollers
Left—Erecting Mule Headstock
Below—Boring and Drilling Machines



India—A Field for American Machinery

By F. LESLIE-JONES

Far Eastern country on the threshold of huge industrial development — How machinery is distributed in India — Competition with foreign manufacturers and how to meet it

THE AMERICAN manufacturer and exporter has not yet begun to appreciate the extent and value of the field offered him in India for the expansion and development of his foreign trade; or if he has he is laboring under some effective difficulties as to the means and methods by which he might avail himself of these opportunities. Whichever reason is the cause of his comparative absence or comparative ineffectiveness in that market, the conspicuous fact is that, except in the most isolated instance, he is neglecting a market of greater capacity of demand and greater attractiveness than any other foreign field with which he considerably concerns himself.

India is one of the world's largest consumers of manufactured products, and her present demands, large as they are, are but in the earlier stages of their growth. India, herself, does not possess the manufacturing capacity necessary for the supply of these products, and while her demands continue to increase rapidly the development and growth of her own manufacturing capacity cannot keep pace with them. It is these conditions that make India so worthwhile and attractive a field for international trade.

The American manufacturer of machine tools and accessories—as the American manufacturer and trader in general—does not realize the importance of the market existing for his products in India, its activity and its rapid growth. During recent years American machine tools have been placed in India, and are even still being placed there. But this introduction is being effected promiscuously, completely out of all proportion to the capacity of American manufacturers to meet the demand, and in practically no effective instance is the American machine tool trade being engineered and established in India, either directly or through agency channels, on a basis of permanency and security, or in the interests of American manufacturers.

Selling Agencies Now Employed

The agencies through which American machine tools have been, and are being introduced into India are almost strictly accidental to the manufacturer. During the war, and after, when the customary British, German and other European sources of supply, in the interests of which these agencies were originally and primarily and purposely organized, were unable to meet the Indian demand, American machine tools presented an excellent source of supply for such agencies. This was the institution of American machine tool trade with India, and practically no American machine tool manufacturer is operating in this field except through such agencies. With the recovery of the European production markets, the imports of American machine tools into India have rapidly decreased while the Indian demand has been growing steadily larger. The American machine tool has served the convenience of foreign interests. The American machine tools introduced today through these agencies are largely tools either of special design or particular adaptability which are at present only readily procurable from America, except where the consumer specifically demands a replacement or duplicate of an American machine which he has been supplied with in the past.

American Trade Insecure

Thus while American machines have been introduced into India, and while some are still being supplied, the fact remains that the American manufacturers' hold upon the trade and contact with the market are quite promiscuous and superficial, and their trade with India is consequently insecure, and faced with decline in spite of the rapidly growing market in that country.

This condition is not peculiar to the machine tool trade but is affecting American trade with India in all lines of manufacture. There has been no practical cultivation and development of the market in the strictest interests of the American manufacturers. As has been pointed out above, this has been the effect of an almost universal policy of agency appointments adopted by the manufacturers. These agencies, especially the well-established of them which are the most sought after, have appreciated the value of the market to them. They have been established in the development of trade in behalf of British and other European interests. If it had not been possible for them to tide over their curtailed supplies during recent years by securing them from American sources they would have suffered a loss. They avoided their loss at the temporary gain of American manufacturers. They are now gradually able to return more assiduously to the care of their recovering, original, primary interests. This is not a question of international bias or prejudice; it is simply a matter of national interest, a natural and important feature in the development of any nation's foreign trade.

These agencies have managed their affairs in a strictly business way, but so well that the American manufacturers and exporters, generally, have no practical hold upon the market as yet, and are little able to take material advantage of the present opportunities for trade in the fields.

Our manufacturers have thrown their opportunities of the past for the permanent establishment of an increasing trade with India to the winds, and their present position in the market is easily circumvented by almost every enterprising foreign competitor.

India is about two-thirds the area of the United

States. And the developments producing the demands for every class of manufactured products, particularly machinery are in active progress principally in the provinces and interior districts of the country which are adjacent, mostly, neither to Calcutta or Bombay. While these cities are both excellent centers for purposes of shipping, import and distribution the sales activities of traders must be organized throughout the many and vast inland areas of the country.

It is in this phase, largely, that the lack of proper appreciation of the extent and acuteness of the demand for his products in India has caused the American manufacturer's unsatisfactory organization and unstable development of his trade in the field. And it is upon the realization of these facts, largely, and his consequent proper organization and establishment of his interests and contacts that American trade with India will develop the permanency and extensive proportions that are easily within its reach.

Indian Consumers

The consumers and purchasers of machine tools are too numerous and various for tabulation here, but they may be mentioned briefly to illustrate the different elements constituting the market's demand.

The Government railroads, company railroads, and the independent industrial railroads are extensive users of machine tools in their locomotive repair shops, carriage and wagon (car) shops, structural shops. These shops and factories are as numerous as the convenience and facilities of each railroad demand. They are consequently located at numerous centers throughout the country, generally, though not always, in the larger cities.

In every town and city are the municipal workshops, operated for the upkeep of the machinery and plant and various structural work that comes under the jurisdiction of the municipalities.

In Karachi, Bombay, Madras, Calcutta and Rangoon and every other port of the country machine tools are extensively required and employed in the workshops and factories catering to the repair work and construction work incidental to shipping and port operations. Some of these workshops are operated by the Port Trusts; most of them, however, are private enterprises.

The extensive mining industry of the country is variously spread over the Eastern Provinces of Bengal, the Central Provinces, Central India and Southern India, and these operations along with those of the subsidiary industries depending upon them, and the numerous public and private workshops and factories, demand and use an increasing quantity of machine tools in their individual and relative interests.

The Military Works Department's factories, Ordnance Factories, the Public Works Department's workshops, and special Government-operated factories, as, for instance, those to serve cable and telegraph facilities, are among the principal Government consumers and purchasers of machine tools.

Now, it must be apparent that the American manufacturer of machine tools, proceeding as he has done and is still doing, to operate through a restricted sales-agency (generally limited to one agent), which agency is in most cases at present mainly and constitutionally a foreign machine tool interest, in a country as extensive as India, with the elements of demand being so varied and divergent as above illustrated—it must be apparent that he is in a most preposterous position with respect to acquiring or establishing his trade with India.

It is surely obvious that such a restricted sales-agency is quite incapable of reaching the above-indicated numerous and varied consumers. The consumers are not confined to one or other section of the country but are everywhere. The most active sales-agencies are operative only in restricted areas. In each section of the market and for each line of products there is a locally active complement of agencies.

Now, for instance, the Railway Board in its program for the next five years (from June 30, 1923) calls for the expenditure of approximately $420,000,000 to be spent in reconditioning, renewing and extending the railroad facilities in India. Nearly $200,000,000 of this sum is to be spent in the purchase of rolling stock, tools and stores (excluding coal, coke, oil and building materials). To meet the requirements for the reconditioning and extension of the railway repair and workshops it is planned to spend $40,000,000 of the above in tools and accessory supplies. These purchases will be made independently by the executive purchasing officials of each railway. To reach these purchasers and establish effective sales-contact with them is, clearly, impossible with a restricted agency or representation that is operative in only one or other confined section of the country.

India Offers Large Opportunities

And the same conditions obtain in every field and industry: The movements producing the demands, the consumers and purchasers are distributed over the whole country, the activities are too widespread, and the country too large for American manufacturers, without any specific field interests in their own behalf, and with their present insufficient agency representation, to develop and establish their trade with India.

The solution of the manufacturer's problem, of course, is in the selection and appointment of a proper sales-agent in each section of the market in virtue of the particular ability of such agents to cultivate and maintain the trade in the respective manufactures. This can be effectively done and must be done. It appears surprising that the agents of American manufacturers have not themselves effected this solution; but for an agent to appoint sub-agents would mean, immediately, the diminishing of his percentage commissions or profits, and in many cases, no doubt, would mean, eventually, too great an introduction of American products into the market—both of which conditions, as has been already shown, are not particularly desired by agency interests which are not only non-American but often specifically foreign interests.

The attention of American manufacturers and exporters is being turned towards India. The success of the few seriously active enterprises is arresting attention. The field for the American manufacturer is large, but the market still remains totally unorganized by the American manufacturer in his own behalf. The opportunities offered are potentially vital, and of today, and by the application of serious effort American trade with India can be efficiently established upon a basis of increasing returns, and developed as a permanent channel for the outlet of our increasing capacity and surplus of production.

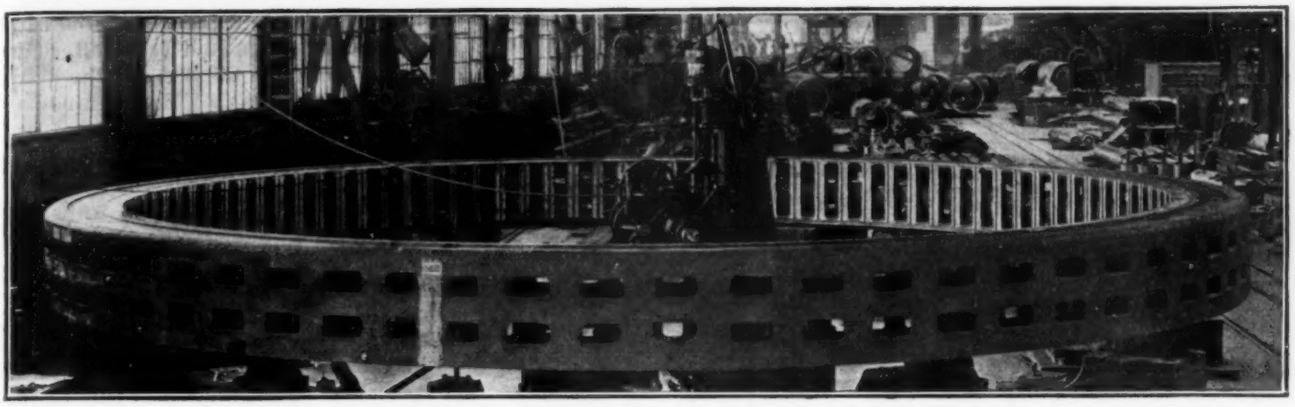


FIG. 1—MILLING DOVETAIL SLOTS IN FRAME

Machining a 37-ft. Generator Stator Frame

BY E. T. SPIDY
Asst. Supt., Dominion Engineering Works, Ltd., Montreal, Canada

IT SEEMS to be the very nature of a machine shop to be getting work that needs a machine just a little larger, with just a little more stroke, or just a little something, different from anything we have.

The machine shop of the Dominion Engineering Works, Montreal, Can., is particularly equipped to handle large work, but even at this, its largest vertical boring mill will only swing work up to 35 ft. in diameter between the housings, and up to 18 ft. high under the crossrail. This is one of the only machines of this size we know of, but when the job comes 37 ft. in diameter, what are you going to do? This was the position with regard to the large generator stator frame shown herewith.

The boring of this frame is shown in Fig. 2. In setting up the stator frame, which is in four sections, the skids were all set up and grouted solidly in the floor. Then a facing cut was taken over the whole twelve of the skids to insure alignment with the table. The distance blocks were then set on each of the skids, they having been planed in one batch to insure uniformity in height. Each section of the stator frame was milled off square on the bottom before the boring operation, the work being done on the large milling machine to be

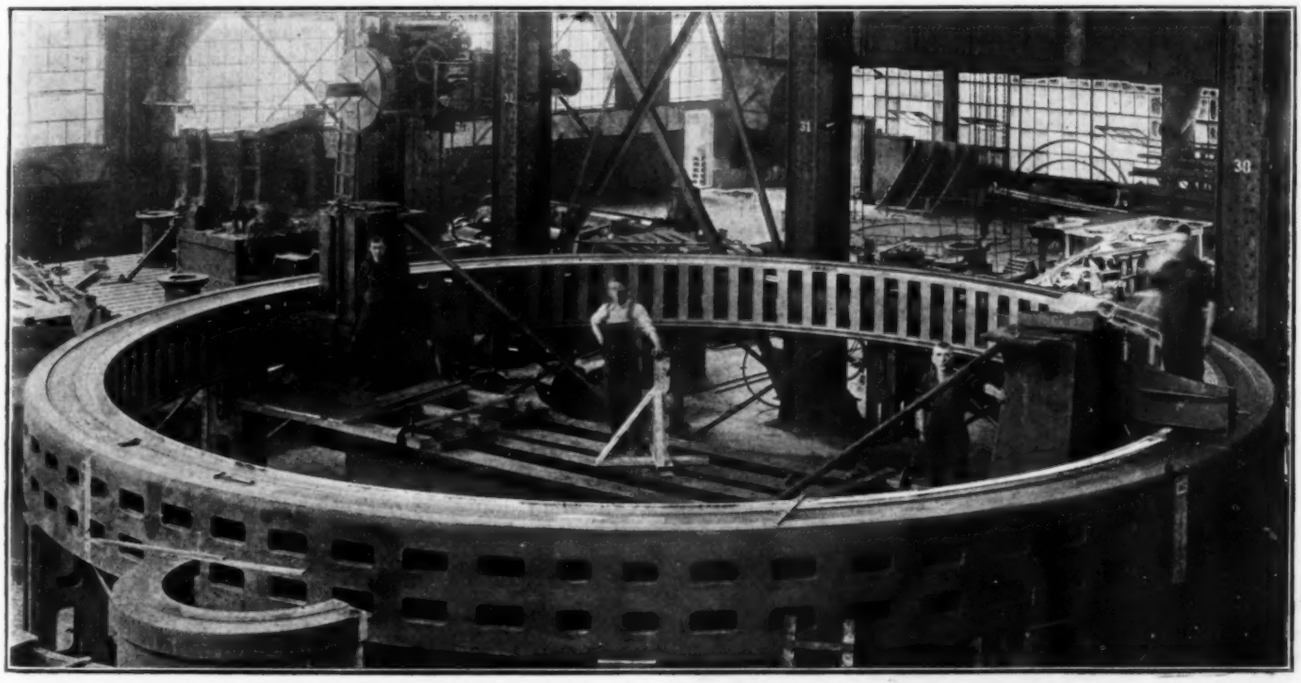


FIG. 2—BORING 37-FT. STATOR FRAME BY IMPROVISED METHODS

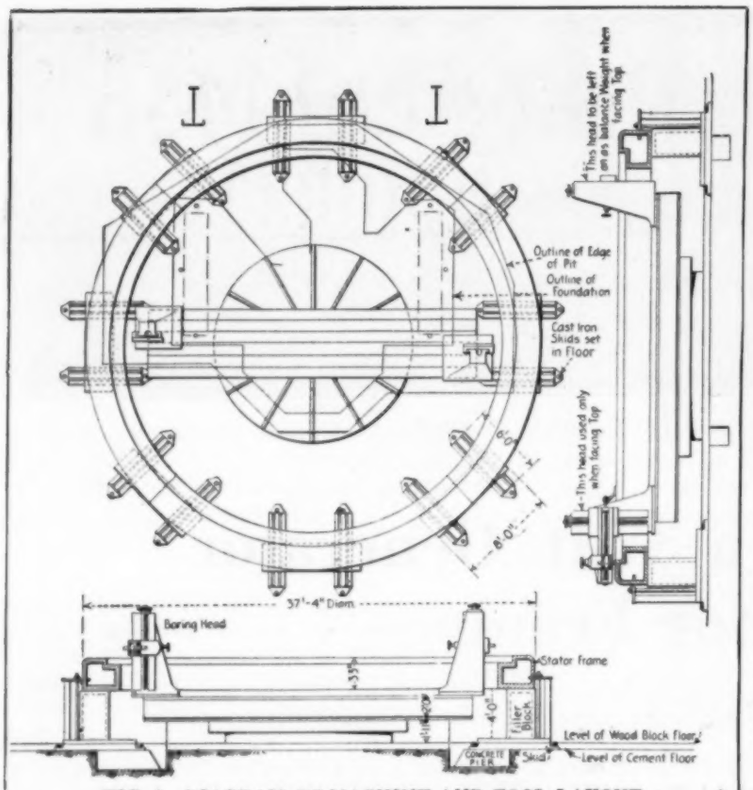


FIG. 3—DIAGRAM OF MACHINE AND TOOL LAYOUT

seen in the rear of Fig. 2. Pin gages were used to check all diameters and, in view of the difficulty of boring over a series of bars such as the interior diameter of this stator frame presented, the job was highly successful.

The diagram, Fig. 3, shows how the boring and facing operations were planned and carried out. A Niles boring mill, regularly rated as being 18 ft. between housings, was decided on as being most suitable for the operations, mainly because of the ease with which the housings and crossrail could be dismantled both from the bed and the drive mechanism of the machine. This machine has a table 16 ft. in diameter, and we fastened two long lathe beds side by side to the table.

On the lathe beds, which extended to the desired internal diameter of the job, we bolted two portable boring and facing heads. So instead of the work being rotated, and the tools held stationary, the process was reversed.

The next operation on the stator frame was to cut dovetail slots down the bars, or ribs, on the inside diameter. This necessitated another special set up. On another part of the floor we set up base blocks, on which we mounted the stator frame as shown in Fig. 1. These base blocks carry rollers on which the whole stator was rotated by means of a chain block attached to one of the shop posts. After each slot was milled the frame was turned to the next position. Internal roller guides were also mounted on the base blocks engaging the internal diameter of the stator, to hold the frame in position during rotation. The slots were accurately laid out and a stationary pointer erected for purposes of setting the frame at the center line of each slot.

A portable milling machine was set up at one point and accurately lined up so as to mill the desired slot vertically. Each slot was first roughed out and then a dovetail cutter was used to finish it. Fig. 4 shows a close up view of this operation.

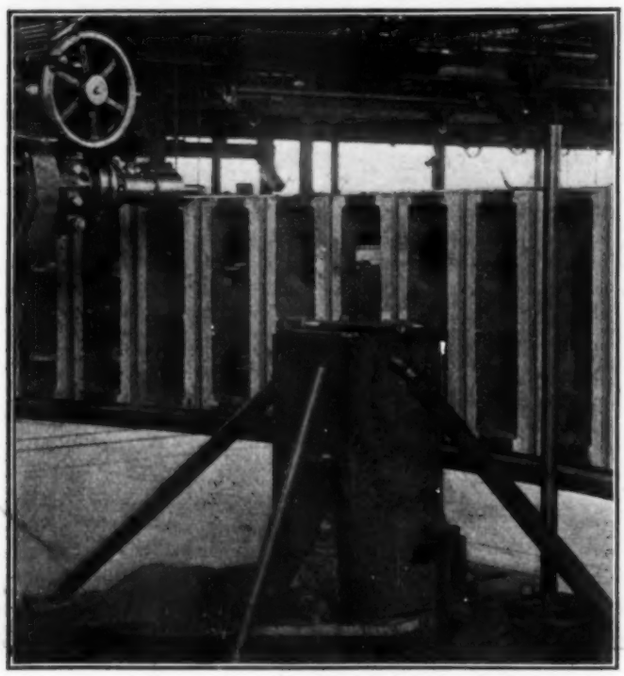


FIG. 4—A CLOSE UP OF THE DOVETAIL OPERATION

Eliminating Fatigue

BY WILLIAM R. BASSET

It has been calculated that, on the average, every workman, each day, turns out 20 cents worth of product less than he might, because of unnecessary fatigue. Multiply that by the number of workers you employ and then by the number of working days in a year and you will be astonished at the total cost to you.

Much of this fatigue can be eliminated.

In one plant as a result of a study, the working day was shortened 45 minutes, proper rest periods allowed and methods of doing work improved. The result was an increase of 35 per cent in the daily production. Similar results have been achieved in many plants.

The common causes of unnecessary fatigue are:

Poor light — Noise
Awkward position — Improper tools
Too high or too low speed of working.

I have seen production of bench workers increased 22 per cent merely by raising the height of the stools 2 in. Unnecessary noise has been found to be very tiring.

Anyone doing an operation over and over tends to strike a rhythm of movement, which, when found, greatly reduces the fatigue. Inability to find the proper rhythm may result in greatly reduced production. For this reason a rapid pace may be less tiring than a slow one, if it meets the rhythm of the worker.

For the sake of increased profits, if for no other reason, it pays to study the methods of doing work, so that needless fatigue may be eliminated.

Ideas from Practical Men

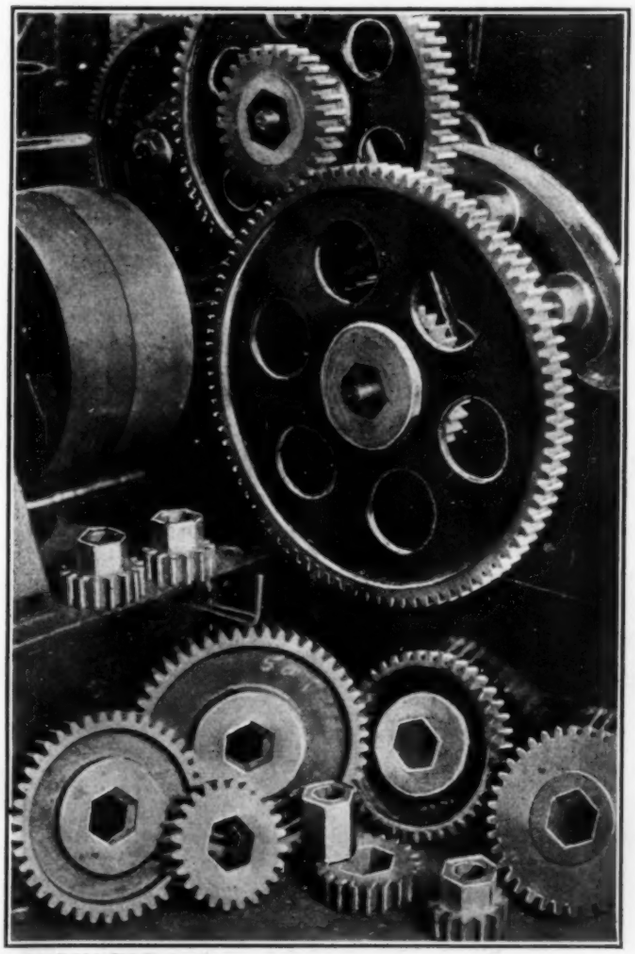
Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for

Hexagonal Holes in Change Gears

BY JOHN WILLIAMS

Ever since the screw-cutting lathe was invented, and perhaps before, we have had change gears; and the universal method of holding them stationary with respect to their driving or driven shafts has been by means of the "key," "spline" or "feather," as it is variously called.

So long as the powers transmitted by such gears are



CHANGE GEARS WITH HEXAGONAL HOLES

relatively small the spline is a very satisfactory driver, is not too difficult to make, and is very easy to manipulate when changing gears. Perhaps its most serious drawback is its tendency to work loose during years of service and eventually to get lost at a most inopportune moment when changing gears on a hurry-up job.

On the other hand, as powers increase in proportion to the allowable size of gear hub the single spline is unable to carry the load and the multiple spline is the method usually adopted, but the multiple spline *is* difficult to make, especially when the shafts are to be hardened. The accompanying illustration shows another method that is used by one of the manufacturers of heavy machinery that requires change gears.

The holes in the gear hubs are broached to a hexagon shape and the ends of the shafts upon which the gears are to be mounted are milled accurately to fit them. Bushings, having round holes for the studs and made hexagonal upon their outer surfaces, provide for compounding. This method has the advantage of increased strength without loose parts, and the gears will go to place in any one of six positions.

This application is shown by courtesy of Mr. Hartley, of Sleeper & Hartley, builders of wire-coiling machinery. Mr. Hartley does not claim to have discovered anything new, but merely to have applied a well-known principle to his purposes to overcome the trouble caused by the inadequacy of the single spline.

Turning Convex or Concave Surfaces in the Lathe

BY HARRY S. CLARK

A concave or convex surface may be turned upon the face of a piece of work held in the chuck of a lathe by means of the following simple expedient:

Procure a piece of drill rod of about ¼ in. diameter and of a length sufficiently greater than the desired radius to allow the ends to be ground to a sharp point and finish to the exact length of the radius.

Next make a prick-punch mark in the cross-slide of the lathe at a point about midway of its length; on the side toward the tailstock if a concave surface is to be turned or toward the headstock if the desired surface is to be convex. Make a corresponding prick-punch mark at the same level upon the adjacent surface of the tailstock or headstock, as the case may be.

The work should be roughed out approximately to shape by the aid of a templet. It can then be finished to the exact radius by putting a sharp round-nosed tool in the toolpost, setting the double-pointed rod into its respective prick-punch marks and feeding the cross-slide inward or outward, to or from the center of the work, while the carriage is held back against the rod by means of the traverse handwheel.

It makes no difference what position the point of the tool occupies with respect to the end of the pointed rod except that it be at the center of the work when the rod is parallel with the shears of the lathe; its movement will describe a true arc of a radius equal to its length. The tool may be adjusted for successive cuts by tapping it out after partially tightening the toolpost screw, or the same result may be obtained by advancing the tailstock if the rod is on that side. If the lathe is provided with a compound rest, the setting of the tool is much simplified, for if the rod is used on the side toward the headstock the only adjustment possible is of the tool itself.

A Fixture That Reduces Milling Costs

BY DONALD A. HAMPSON

A milling fixture used for machining the three surfaces of the casting *A*, is shown in Fig. 1. The cuts to be made as at *F*, Fig. 2, originally required three separate operations, the pieces being clamped in a row and a set of them being run while the operator loaded another set on the second one of the removable "magazines." This method was slow because of the number of handlings and, during the latter operations, the castings were apt to lose the necessary degree of parallelism and accuracy.

A glance at Fig. 2 would seem to indicate that the

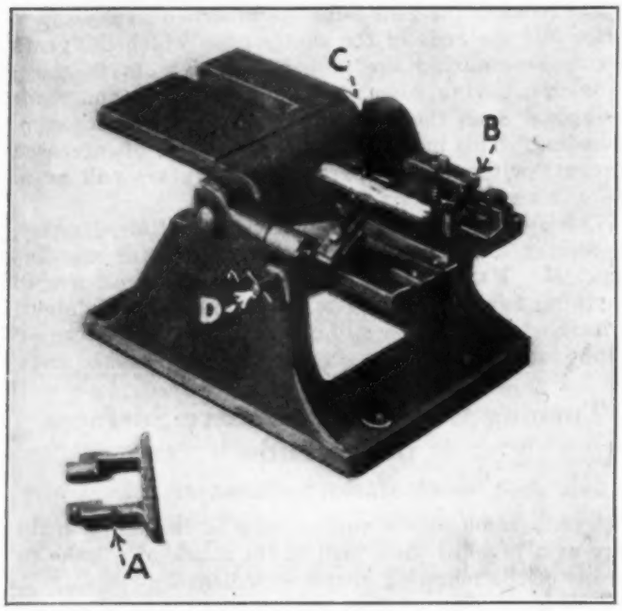


FIG. 1—FIXTURE AND WORK

work could best be done by three end mills carried in as many spindles. However, the width of slot that must be maintained takes the work out of the end mill class.

Obviously, the most economical way to do the work is to machine all three surfaces at the same time. But the lengths of the slots and of the facing cuts differ more than 50 per cent while the distance required for the periphery of a plain mill to enter its full depth is much more than that needed for a small end mill to approach its cut and pass off again. Then too the cutter speeds must be approximately equal if they are to have the same life between grindings. The arrangement of machine and the fixture design had to be such that adjustments could be made after sharpening and the tools will take care of three sizes of iron castings, differing only in the dimension *X*, Fig. 2.

The plan of operation is shown in Fig. 3. It will be noted that the fixture has a double ended work table that revolves about a horizontal axis. The cutting action resembles that in bridge milling, once so common in firearms work, and the work table is of cantilever design. In the cutting position, the castings are on the under side of the table. This keeps practically all the chips off the work and what few are left are dumped when the table is revolved. A size of end mill is used for the facing cut that just sweeps the work. Its position is ahead of the other two spindles, situated so that it finishes its cut at the same time that the plain slotting mills have just cleared the work.

This fixture has secured a two-thirds reduction in the cost of making these pieces. A further benefit results from the relation of the various machined faces, which now is fixed. The cleaning and brushing, one of the greatest evils of mills, is made unnecessary by this fixture. The operator does not need a brush, for every-

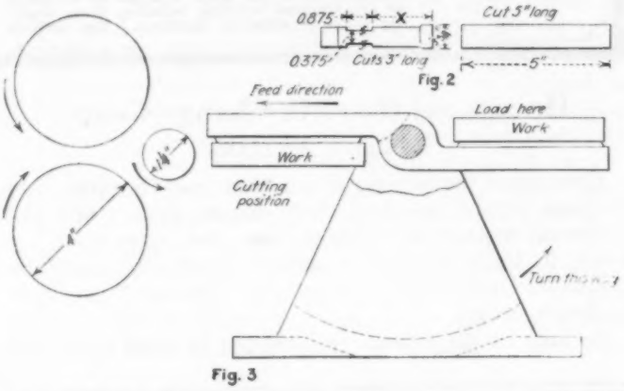


FIG. 2—END ELEVATION SHOWING CUTS. FIG. 3—HOW THE FIXTURE WORKS

thing in the chip line has vanished by the time the table reaches the loading position.

The clamps for holding the work *A*, Fig. 1, are shown at *B*, and a gage for setting it at *C*. The index pin is at *D*. The gage swings out of the way to allow the table to roll over. On account of the shape of the work it was necessary to arrange stops to take the thrust of the cut. One of the stops is adjustable to make up for foundry variations and the operator brings this up after the rest of the clamping.

The three-spindle arrangement of the milling machine is illustrated by Fig. 4. Two old machines contributed to the arrangement employed on this job —one a Lincoln and the other a duplex milling machine, At the left is the headstock of the Lincoln milling machine with its back-gear pulley, the back gears themselves being moved outside the far end of the headstock.

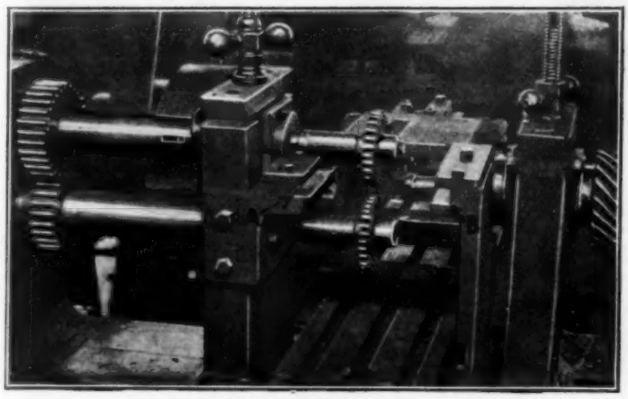


FIG. 4—THE CUTTERS AND GUIDES

At the right is one of the duplex milling machine headstocks, which carries the spindle with the end mill and runs at 270 r.p.m. A second spindle has been added to the slow running head and receives its drive through the spur gears at the left. The same countershaft with same size pulleys drives both heads but the back gears reduce the speed of the cutters 3 to 1, which gives a satisfactory cutting speed for all.

The cutting end of the fixture table appears in Fig.

3 to have no other support than its own strength—a cantilever piece extending toward the cutters. But just before the cut begins, the table enters, slides at *A* and *B*, Fig. 4, which support and guide it on each side. The fixture table travels in ways just as does the machine table below it and in this way steady fast cutting is possible.

The height of the center pin is the working point for setting cutters vertically. The end mill spindle coincides with this height while the other spindles have screw adjustments. To compensate for the three sizes of castings in use, the end-mill spindle is moved longitudinally with its headstock. The clamps and locating pieces on the fixture are also moved.

Tap-Clearance Tool for "Blind" Holes

By J. T. Towlson
London, England

In tapping "blind" holes, the operation will be greatly facilitated if clearance is made for the tap at the bottom of the holes.

A tool for cutting such tap clearances is shown in the accompanying illustration. The tool consists of a shank, slotted at one end to receive two cutters which are pivoted to the shank and are free to swing. Fig. 1 shows the shank and cutters entered in a hole to be tapped with a 2-in. Whitworth thread. The bottoms of the cutters have no clearance and are at an angle from the horizontal.

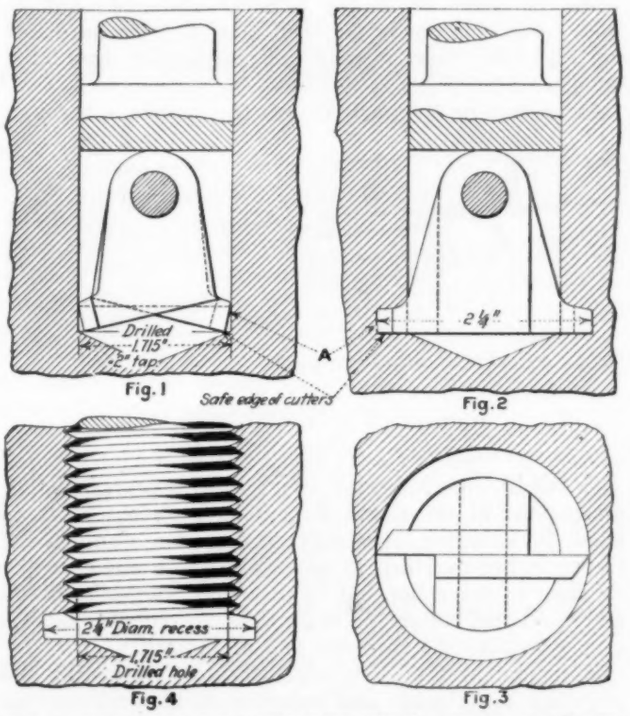


FIG. 1—THE TOOL IN A DRILLED HOLE. FIG. 2—CUTTERS EXPANDED IN THE HOLE. FIG. 3—BOTTOM VIEW OF TOOL WITH CUTTERS EXPANDED IN THE HOLE. FIG. 4—SECTION OF TAPPED HOLE SHOWING CLEARANCE FOR THE TAP

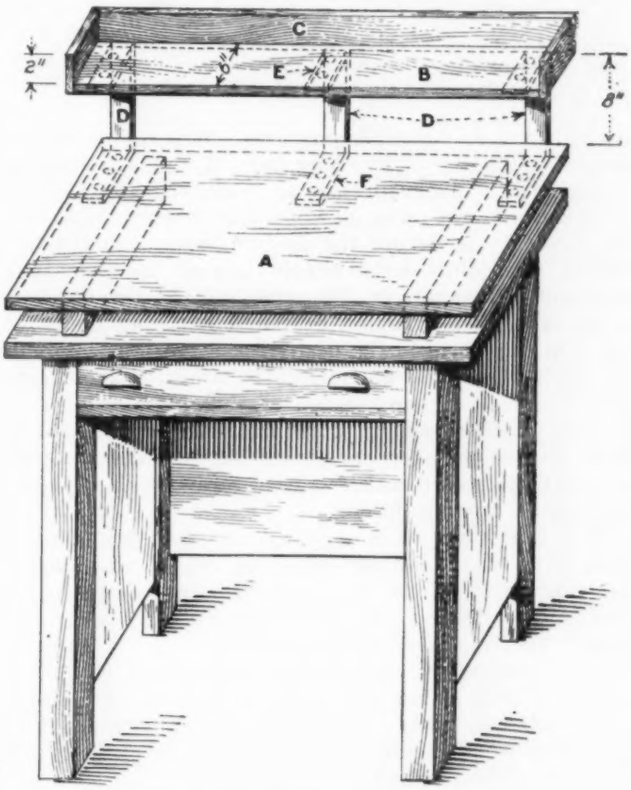
Downward pressure, as in drilling, forces the cutters to expand so that the edges *A* cut a groove in the wall at the bottom of the hole, as shown in Fig. 2. A bottom view of the tool with the cutters expanded in the hole is given in Fig. 3, while in Fig. 4 is a section of a tapped hole showing the clearance for the tap. A tool of this kind will soon pay for itself in the prevention of tap breakage.

Convenient Shelf for Drafting Table

By Albert A. Dowd

Every well appointed drafting room endeavors to provide each draftsman with a reference table or shelf on which he can keep books, instruments or drawings. There are many cases however when congested quarters make a reference table impractical, so that the draftsman is hard put to find a place for his things.

The illustration herewith shows a drafting table *A* with a convenient shelf *B* supported on braces *D* in such a way that it does not interfere in any way with the use of the T-square and very seldom with the triangles. The shelf is made of wood and has a projecting ledge *C* around it on three sides to prevent things placed on it from falling off. The shelf should be placed not less than 8 in. above the upper surface of the drafting table and it should not be much over 6 in. wide. The braces *D* are made of ⅞x1 in. flat stock and bent at an angle according to the tilt of the drafting board at *F*. They are screwed on the underside of the board with several wood screws and have a right-angle bend at *E* to support the shelf. Wood screws are also used here to fasten them in place.



THIS SHELF IS A VALUABLE ACCESSORY TO A DRAFTING TABLE

A shelf of this kind is a most convenient thing for any draftsman, as he can place on it at one end his reference books that are in constant use, and there is also plenty of room to lay instrument case, triangles and other tools such as pencils and erasers. These items are always at hand when needed, yet never in the way.

Two Railroad Shop Tools

By Herbert F. Crawford

The illustrations show two devices that were recently seen in a contract shop which is repairing locomotives. The first is a gage for use in making new taper keys to replace old ones. It was designed for keys used in taking up the brasses in the back end of the main rod, or at the crosshead pin end, but is equally

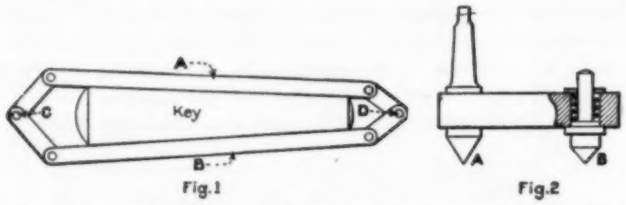


FIG. 1—GAGE FOR TAPER KEYS. FIG. 2—DEVICE FOR SCRIBING CIRCLES ON WHEEL HUBS.

useful for keys for other purposes. It is a very simple device, consisting of two long bars, *A* and *B*, connected at each end by short links, so as to allow the bars *A* and *B* to assume any relation with each other which may be necessary to secure the desired taper. In the tool shown, the joints were simply riveted together in a substantial manner, in the same way as the old firm joint caliper, the friction of the joint being depended upon to hold them in the desired position. In case this should not be found entirely satisfactory, it is an easy matter to put either knurled or thumb nuts at joints *C* and *D*, which will in all probability be sufficient to hold all the members firmly in any desired position. A tool of this kind makes it easy to duplicate keys and saves much time in fitting.

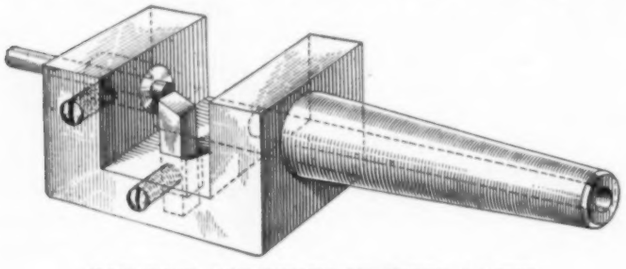
Fig. 2 shows a small scribing device used in connection with the tramming or laying out of valve gears. It is not always easy to tram from the center in the end of the driving axle, as this is usually large and deep. In the device shown, the center *A* fits into the center hole, and as the tool is revolved the scriber *B* marks a circle on the end of the axle, from which tramming is easily done. The scriber *B* is forced out by a spring which holds it automatically in contact with the hub while the tool is being revolved.

Tool for Turning Small Punches

By H. H. Knabe

A simple form of box tool to be used for turning quantities of small punches, or pins of small diameter, from drill rod or similar material has been much used by the writer. It is made to fit the tail spindle of a speed lathe and while there is nothing new about the tool itself I have seldom seen it applied in this way.

The body can be made quickly from a piece of square-



BOX TOOL FOR BENCH OR SPEED LATHE

sectioned cold-rolled steel, and any number of sizes of bushings made to take various diameters of drill rod. The turning tool is a standard high-speed steel tool bit, held in place by a setscrew.

If one has any considerable number of small punches to make this tool will soon save its cost by its superiority over the time-honored method of holding the drill rod in a chuck or collet and worrying off the stock from the unsupported end slowly enough so that the piece will not double up or break.

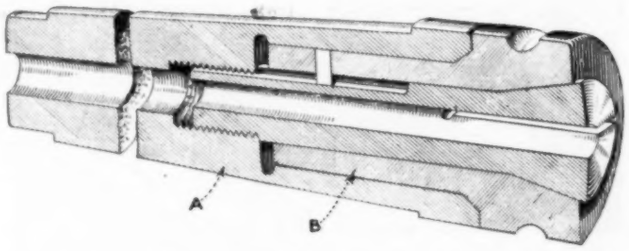
An Adapter for Spring Collets

By Milton Wright

A very neat adapter to hold spring collets in the spindle of a lathe that has no through hole, or is not fitted with a drawbar, is shown in the attached sketch. In order to be accurate, the adapter requires careful workmanship in the making, but any toolmaker whose work demands the accuracy of the bench-lathe collet should possess the skill necessary to make it.

The outer shell *A* is fitted to the taper hole in the spindle of the lathe in which it is to be used, but is not bored to fit the collet. Instead, a parallel hole, or recess, is made to fit the knurled sleeve *B*, and in order to do this nicely the shell must first be hardened and the hole then ground in position in the lathe spindle.

After turning the part A to fit the spindle, a through



ADAPTER FOR SPRING COLLET

hole of the desired size is bored and then counterbored to a depth and diameter equal to the corresponding dimensions of the sleeve *B*, leaving sufficient stock to finish by grinding. The outer end of the counterbored recess is bell-mouthed to about the same angle as the shoulder of the collet, but is, of course, larger in diameter. At the bottom of the recess the smaller hole is tapped to take the threaded end of the collet.

After finishing part *A*, which includes hardening and grinding both inside and out—the inside and bevelled seat being ground in position—the sleeve *B* is made. This should be a very good fit in part *A* but must turn freely with the fingers. The hole in *B* is to be a good fit for the collet and is bell-mouthed to form a seat for the latter. A feather, which may be a round pin flatted off on two sides where it projects into the bore, is fixed in part *B* to act as a key in tightening the collet.

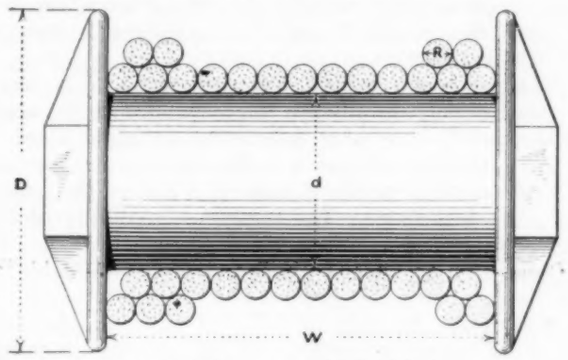
The collet is slipped into the sleeve through which the threaded end projects. The combined parts are then put into the shell *A*, the threads of the collet entering the threads in *A*, and screwed up by means of the sleeve which, by reason of the feather fitting the keyway in the collet, causes the latter to turn with it. When the collet is tightened the bevelled shoulder of the sleeve seats in the correspondingly bevelled recess in *A* in the same manner that the collet itself seats in the sleeve.

This device has the disadvantage of having two conical seats instead of one, but if the work has been carefully done the collet will run as true as if held with a drawbar. The main advantage possessed by it over the type that depends upon some sort of cap to *push* the collet to its seat, lies in the fact that the end of the collet is as fully exposed as when a drawbar is used, and the worker can thus get up close with his tools.

The Capacity of Drums for Wire Rope

BY HENRY C. ORD

This subject is not a new one, but in the formula given there is a new factor that is very important, and especially so when estimating the line capacity of a narrow drum for a rope of large diameter.



CAPACITY OF A ROPE DRUM

Due to the helical (although often called spiral) winding of the rope on the drum, one-half coil is lost at each end, or one coil for each complete layer on the drum. Consequently, when estimating the rope capacity the diameter of the rope should be subtracted from the width of the drum. This value $(W - R)$ is used in the formulas that follow, where,

D = diameter of drum flanges in inches.
d = diameter of drum barrel in inches.
W = width of drum in inches.
R = diameter of rope in inches.
L = length of rope in feet.

The following procedure was used for the derivation of the desired formulas:

When the drum is filled with rope the mean diameter of the coils will be $\frac{D+d}{2}$, and the mean or average length of the coils in feet will equal

$$\frac{D+d}{2} \times \frac{3.1416}{12} = \frac{D+d}{2} \times 0.2618.$$

The number of coils will be

$$\frac{\frac{D-d}{2} \times (W-R)}{R^2}.$$

The length of the rope in feet will equal the mean length of the coils in feet, multiplied by the number of coils, or

$$L = \frac{D+d}{2} \times 0.2618 \times \frac{\frac{D-d}{2} \times (W-R)}{R^2}.$$

Reducing to the lowest terms,

$$L = \frac{0.06545 \times (W-R)}{R^2} \times (D+d) \times (D-d)$$

Or, $$L = \frac{0.06545}{R^2} \times (W-R) \times (D^2-d^2) \quad (1)$$

From this equation by transposing we find

$$D = \sqrt{\frac{LR^2}{0.06545(W-R)} + d^2} \quad (2)$$

$$d = \sqrt{D^2 - \frac{LR^2}{0.06545(W-R)}} \quad (3)$$

$$W = \frac{LR^2}{0.06545(D+d)(D-d)} + R \quad (4)$$

$$R = \sqrt{\frac{0.06545(W-R)}{L}(D+d)(D-d)} \quad (5)$$

In formula (5), as the value of the factor $(W - R)$ is not known, use W for the first approximation and solve for R. Then subtracting this value of R from W and solving again gives a closer approximation to the true value of R; if necessary this procedure may be repeated for a more accurate value. The value of R from the first approximation will be too large, and from the second a trifle small, although close enough for all practical purposes, as we would have to use the nearest commercial size of rope.

Let us now examine the capacities of rope drums under these conditions:

(a) The comparative length of rope of different sizes on the same drum.

(b) The comparative length of rope of the same size on drums of different widths.

Let W = width of wide drum.
w = width of narrow drum.
R = diameter of large rope.
r = diameter of small rope.
L = length of large rope.
l = length of small rope.

(a) $L = l \times \frac{r^2(W-R)}{R^2(w-r)}$ $\quad l = L \times \frac{R^2(w-r)}{r^2(W-R)}$

(b) L = length on wide drum.
l = length on narrow drum.

$$L = l \times \frac{W-R}{w-r} \qquad l = L \times \frac{w-r}{W-R}$$

From the above it will be evident that the longer the drum the greater the efficiency for any size of rope, and the larger the rope the lower the efficiency for any size of drum. As an example, let the width of drum $W = 10$ in. and size of rope $R = 1$ in. Then the efficiency $E = \frac{10-1}{10} = \frac{9}{10} = 90$ per cent. If $W = 20$ in., $E = \frac{20-1}{20} = \frac{19}{20} = 95$ per cent.

An infinitely small rope and a drum 10 in. wide gives $E = \frac{10}{10} = 1$, or 100 per cent. A rope 1 in. in diameter gives $E = \frac{10-1}{10} = 90$ per cent; and a 2-in. rope gives $E = \frac{10-2}{10} = 80$ per cent.

The diameter of the drum has no effect on the efficiency as regards capacity; but it is a well-known fact that the larger in diameter the barrel of the drum, the longer the life of the rope.

American Machinist
Established 1877
KENNETH H. CONDIT AND FRED H. COLVIN
Editors

December 27, 1923

Fair and Warmer —or Unsettled?

WITH the passing of the Christmas holiday season when most people are too busy with other things to bother with orders for machinery the industry can prepare for the new year. The vital question is—will business improve or merely hold its own?

Keen business men are keeping a weather eye on Washington. The President's message was an entirely satisfactory document and the country knows where he stands. But Congress has shown a conspicuous inability to get down to business. Some of the members feel that the country is not greatly in need of more laws and we are inclined to believe that there is some foundation for their attitude. Certainly there is little enthusiasm for the kind of legislation some Washington luminaries would fasten on the railroads.

Apparently no startlingly constructive action is to be expected from Congress. On the other hand, it does not seem probable that any faction is strong enough to pass undesirable bills over the President's veto.

As to the Administration it will certainly do all in its power to keep business going at a steady pace. A presidential campaign will soon open and Mr. Coolidge will undoubtedly be a candidate.

When it comes to general business prospects forecasters disagree, but those in whom most credence can be placed do not look for any serious or immediate recession. In the machine shop field indications are favorable. The railroads will have some money to spend on shop equipment. Automobile plants are planning for large production schedules. Electrical machinery manufacturers are very busy. Industrial buildings contracted for should require many machines when they are ready for occupancy.

Conditions abroad are not all they might be in some countries but on the whole are much nearer to stability than they were a year ago. Japan, the latest victim of calamity, is working courageously to rebuild her shattered cities and plants and may be looked to for machinery business. England seems at last to be emerging from her long depression. France is busy on account of her depreciated currency. Germany shows signs of returning sanity. Russia does not.

At present no serious labor troubles are in sight unless there is a flare-up in the bituminous coal fields in the spring. There is little unemployment and the principal problem seems to be to work out a progressive and practicable immigration program.

So much for our guess concerning 1924 business. As always, the *American Machinist* will endeavor to give its readers an accurate picture of developments in their industry and to offer constructive suggestions.

Hit or Miss Tool Grinding

WHILE MANY may not be willing to admit that there is necessarily one best way for doing all jobs, few will deny that some cutting angles must be better than others, at least for the same shop conditions. And yet we frequently see almost identical work being done, sometimes in the same shop, with cutting tools which differ widely in shape, rake and clearance.

It is to be regretted that we do not know more about cutting tools. But it is very evident that top rakes of two degrees and eighteen degrees cannot both be best for the same job. Nor should it take long to discover which top rake gives better average results on the work in hand. And having found a top rake which gives good average results, the logical step would be to make this standard until later experience discovers one which is better.

Standard tool grinding, however, seems to be one of the most difficult of all shop improvements to put across. It is many years since good tool grinding machines became available and yet it is the exception rather than the rule to find standard lathe and planer tools issued from the tool room. The individual grinding of tools still holds in a great majority of shops.

Opposition to such a change is understandable and inevitable and in too many cases it is left to the discretion of the foreman of different departments. Such a method, however, reflects directly on the shop management and the responsibility must rest at the top, where it belongs.

Failure to standardize cutting tools reveals either a lack of appreciation of its importance or of inability to sell the idea to the foremen and to the men. Arbitrary edicts and methods usually fail in such cases. But a skillful manager can sell the idea to his men by making them see that it not only relieves them of the work, but enables them to increase their production and earnings.

A little diplomacy, especially when the management has already established a reputation for fair dealing, will remove the difficulties in making the change. And it is a change which will benefit all concerned.

Melting Pot or Dumping Ground?

ONE of the suggestions emerging from the discussions on immigration policies is that the quotas be fixed and the contract labor law repealed. The selection of immigrants then would be made largely by employers.

When contracting in a foreign country for labor, employers would be bound to invest appreciable sums in passage and expense money, and would choose their risks carefully. It seems clear that they would select the labor best equipped in knowledge, skill and health.

The plan suggested appears to be a simple solution of a serious problem, although it would require legislation and supervision. But so will any other satisfactory arrangement and this one seems to be pointed toward continuing America as a melting pot, but limiting its scope as a dumping ground.

Shop Equipment News

Fellows Full-Automatic Gear Grinder

A full-automatic involute gear grinder with some unusual features of design and operation is a recent product of the Fellows Gear Shaper Co., Springfield, Vt. The company has developed several types of involute grinders during the past 22 years and the machine illustrated in Fig. 1 is the cumulative result of this experience. All of the features found necessary for the production of accurate involutes are incorporated.

The grinder itself is used in conjunction with accurate reference gages and an involute testing instrument, so that the machine is one part of a complete system for the production of accurate involute tooth profiles. The basis for this procedure lies in the fact that standards of known accuracy must be established and means devised for keeping the work within the limits of these standards. This means the use of reference gages for every size of gear it is desired to grind, and measuring instruments of sufficient delicacy to detect the most minute errors in the finished product.

The grinding machine consists of two sections, one right-hand and one left-hand, as shown in Fig. 1, and is entirely automatic in operation. After setting up the machine it is only necessary for the operator to locate and clamp the gear on the work spindle and then pull a lever. The machine automatically takes care of the rolling action of the gear against the flat surface of the grinding wheel, indexes for each tooth, trues the flat face of the grinding wheel, and stops when the gear is completed. One, two or more cuts can be taken, provision being made to take care of this automatically.

All operating levers are located at the front of the machine and the base is made square, so that the machines can be set end to end with the maximum economy of floor space. The entire gear box and working members are automatically lubricated. Fig. 2 gives a rear view of the left-hand section of the machine.

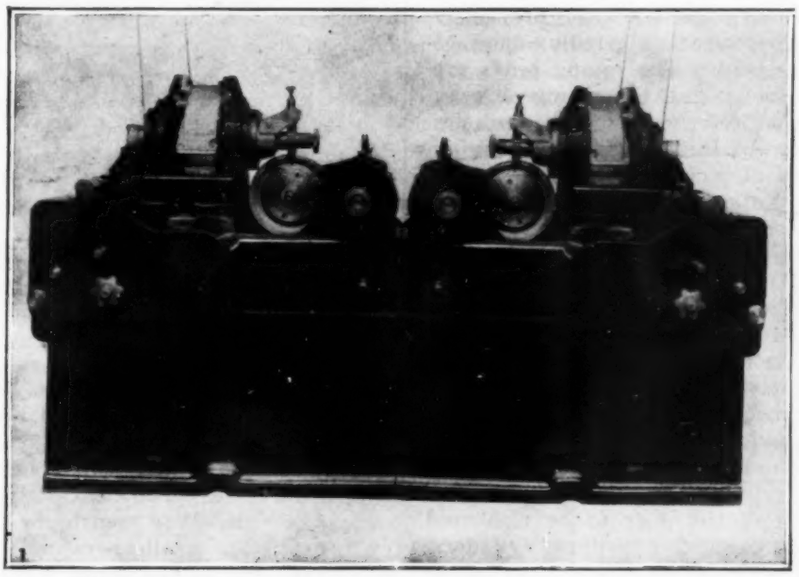
Reduced to its simplest elements, it will be noted that the machine consists of a base, carrying a grinding wheel head which is adjustable for different gear diameters, and a slide upon which is mounted a member known as the "rolling head." The rolling action of this head is controlled by a master involute tooth.

The rolling head is light in weight, being made from a heat-treated aluminum alloy casting, and is balanced to reduce the flywheel effect to a minimum. It oscillates on ball-bearing trunnions which are mounted on the slide, the latter being moved backward and forward by a barrel cam.

The index mechanism and the index plate are incorporated in the rolling head, and this mechanism is designed and constructed to accomplish the indexing of the work without shock in one-tenth of a second.

A master involute tooth is mounted on the outer end of the rolling head as shown in Fig. 3. This is a long involute gear tooth which contacts with an abutment made in the form of a long, straight-sided rack tooth. The master involute tooth, ground on a special machine, is accurate to within 0.0001 in., and both tooth and abutment are made from alloy steel, selected for good wearing qualities, hardened and ground. It is evident that the rolling contact of the master involute tooth upon its abutment resembles the action of a gear tooth upon a rack, and the proper action of the gear tooth with the rack surface of the grinding wheel is insured.

A fine adjustment for the abutment is provided, controlling the pressure angle of the gear tooth being ground. This adjustment is one of the important features of the machine since it gives control of the



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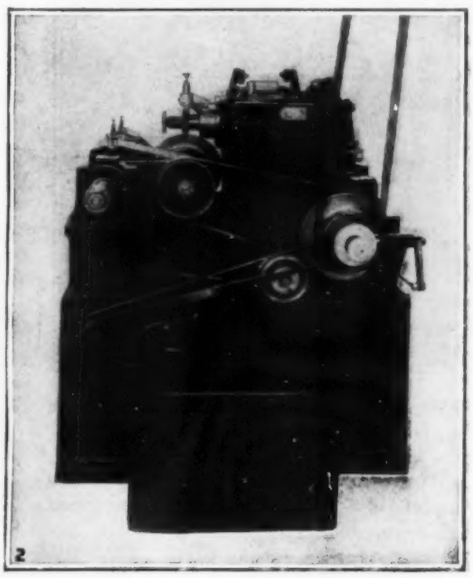

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FIG. 1—FELLOWS FULL-AUTOMATIC GEAR GRINDER. FIG. 2—REAR VIEW OF FELLOWS GEAR GRINDER

accuracy of the finished product and brings it within the very close tolerance of the reference gage which has been adopted. In addition, the adjustment provides means for taking up any wear that may occur.

The diagrammatic view of the rolling head and its appurtenances, shown in Fig. 4, gives a clear idea of the action of the master involute tooth and shows also the method used to insure constant pressure of the work against the grinding wheel. Particular attention has been paid to this matter of pressure, since it is impossible to grind a perfect involute with a varying pressure between the work and the wheel, because the relative rolling action will not be positive and an inaccurately shaped tooth will result. A wire cable is fastened to the rolling head and carries at its other end a heavy weight. Removable portions of the weight are provided, so that the desired pressure of the master tooth upon its abutment can be maintained and, accordingly, the pressure between the work and the grinding wheel.

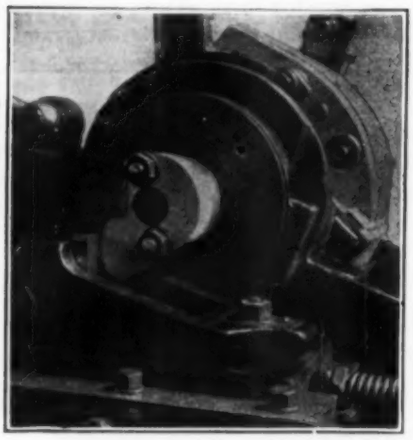


FIG. 3—MASTER INVOLUTE TOOTH ON FELLOWS GRINDER

The grinding wheel used in this machine is unusually small, and it is claimed that the smaller wheel has several advantages. First, the size of the machine is comparatively small and it can therefore be operated at considerable speed; second, an excessively large wheel necessitates a long work arbor with the work not rigidly supported; third, vibration is reduced through the use of lighter parts. It is also stated that greater uniformity of grinding wheel density can be secured in a wheel approximately 10 in. in diameter than is possible in a wheel of larger size.

The small wheel can also be trued faster than a larger one, and the truing device does this automatically. When the amount of dressing required is determined, the machine duplicates the operation, and it can be timed so that the wheel is trued up after the work has made one or more revolutions, as desired.

FIG. 4—DIAGRAMMATIC VIEW OF ROLLING HEAD MECHANISM

The machine is made in right- and left-hand sections as previously noted, each section grinding one face of the teeth. The rolling heads are removable and interchangeable in their entirety, so that no inaccuracies can creep in through the changing of arbors, index plates, master forms, etc. To remove the heads it is only necessary to take off the trunnion bearing caps, and the entire rolling head with its auxiliary mechanism can then be easily lifted out and replaced by another complete head.

As a means for checking and comparing the finished work with the established standard, the involute measuring instrument shown in Fig. 5 is used. This device consists of two cylinders representing the base circle of the gear to be measured and, concentric with these cylinders, the gear is mounted on an arbor as shown. The cylinders roll on hardened and ground steel surfaces and, located in exactly the same plane as these surfaces, a jewel contact point bears against the surface of the tooth to be measured.

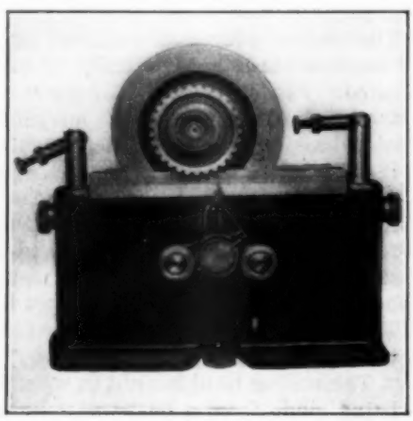
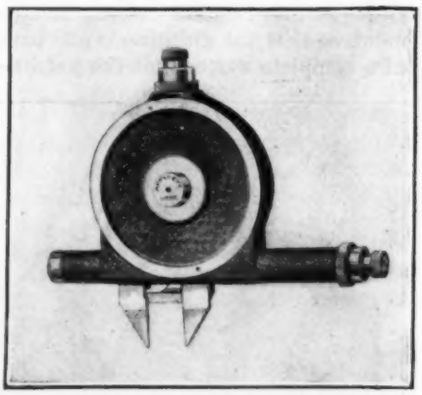


FIG. 5—FELLOWS INVOLUTE MEASURING INSTRUMENT

As the cylinders are rolled along the plane surface, any variation of the tooth curve form a perfect involute is shown by the pointer of the indicator, shown mounted at the front of the apparatus. The indicator shows variations as small as 0.0001 inch.

Zeiss Optical Gear Tooth Micrometer

An optical gear tooth micrometer manufactured by Carl Zeiss, Jena, Germany, is now being marketed in America by George Scherr, 143 Liberty St., New York, N. Y. The instrument is adapted to the direct reading of the chordal thickness of the tooth at the pitch line, and the addendum.



ZEISS OPTICAL GEAR TOOTH MICROMETER

To set the jaws the tool is held close to the eye and two clear scales, engraved on glass, are seen by looking through the small aperature at the center. One of the scales is disposed vertically and the other horizontally in the field.

The scales are moved by turning the micrometer screws until the tooth thickness at the pitch line is indicated on the horizontal scale and the addendum on the other. With the jaws thus set the teeth of a gear can be easily inspected.

The instrument is also useful for checking gear cutters, gages and forming tools. Its range is from 18 to 1½ diametral pitch, and it is graduated to read in thousandths of an inch. It is stated that readings to 0.0001 can be estimated. The weight of the device is about one pound.

Brown & Sharpe No. 34 Gear Hobbing Machine

A machine designed strictly for the single purpose of hobbing plain spur gears, and stripped of all mechanisms, adjustments and attachments that do not contribute directly to that end, is now being marketed by the Brown & Sharpe Mfg. Co., Providence, R. I.

As may be seen from Fig. 1, a front view of the machine, its design follows the general lines of the No. 44 spur and spiral gear hobbing machine, previously described on page 635, Vol. 59, of the *American Machinist*. Because of its limitations, however, it is more compact, more rigid, and its application of power is more direct.

Power is delivered to the machine by belt to the constant-speed, friction-drive pulley, seen in Fig. 2 at the rear of the machine. When the machine is equipped for motor drive, a spur gear is substituted for the pulley and the motor is mounted upon a bracket attached directly to the base.

Variation of the speed of rotation of the hob spindle is effected by means of change gears located on the front of the machine at the right and thus easily accessible. Through these gears the horizontal multi-splined shaft on the back of the machine, seen in Fig. 2, is driven, and this shaft transmits its motion to the hob spindle through worm and bevel gearing located within the housing below the balance wheel. The worm is carried upon separate bearings within the housing and moves lengthwise of the splined shaft as the carriage advances.

The hob carrier or carriage is made somewhat like the carriage of a lathe and is gibbed to ample bearing surfaces machined on the base. It is made in two parts, the upper part carrying the hob spindle and adapted to swivel to any angle up to 10 deg., in one direction only. A vernier, reading to 5 min., facilitates accurate settings. The amount of swivel must correspond to the helix angle of the hob in use and, as it is in but one direction, only right-hand hobs can be used. Because of the limitations in this respect practically all of the complicated spindle-driving mechanism of the helical and universal gear hobbing machine is eliminated, and a strong, direct drive is substituted.

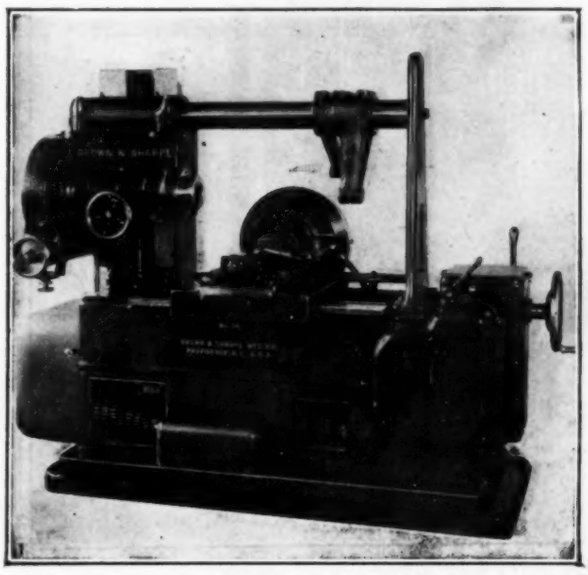
The swivel takes place about the center of a short vertical shaft which transmits the power from the worm upon the splined shaft to the bevel gear that drives the hob spindle. The partial rear view of the machine with the balance wheel removed, Fig. 3, shows the construction. The driven bevel gear is mounted upon an internally splined sleeve running in independent bearings. The hob spindle is located inside the sleeve and is driven by it.

This construction relieves the bevel gears from all deflecting strains that may be caused by possible springing of the hob spindle itself and allows them to perform their functions under conditions of maximum efficiency. It also provides for endwise movement of the hob spindle, in order to bring the hob to bear upon its work in different positions, so that advantage of the whole length of the hob may be taken at each grinding.

The hob spindle rotates in a substantial bearing, the housing of which is integral with the swivelling member of the carrier. This bearing is supplemented by a movable outboard bearing, so designed that the hob is supported on both sides, minimizing any tendency to spring or chatter. A balance wheel of unusual size contributes to the smooth action of the hob.

The work-carrying spindle is mounted in a head gibbed to slide vertically upon the face of a column, and is provided with an elevating screw having a micrometer dial for fine adjustments. The spindle rotates in bronze bearings of ample proportions. The front journal is tapered and the rear end of the spindle is fitted with a compensating device by means of which adjustment may be made for wear without disturbing the alignment of the index wheel. The spindle has a through hole $2\frac{1}{2}$ in. in diameter and the front end is made to take a No. 16 B & S taper shank. The spindle nose is fitted to receive faceplate or fixtures. A rigid overarm and brace furnish an outboard support for the work when it is carried upon an arbor.

The index wheel is a cast iron worm gear, hobbed in place upon its own spindle. It is driven by a hardened and ground steel worm mounted upon a sleeve at the bottom of an enclosing case, where it runs in oil. The mounting is so arranged that



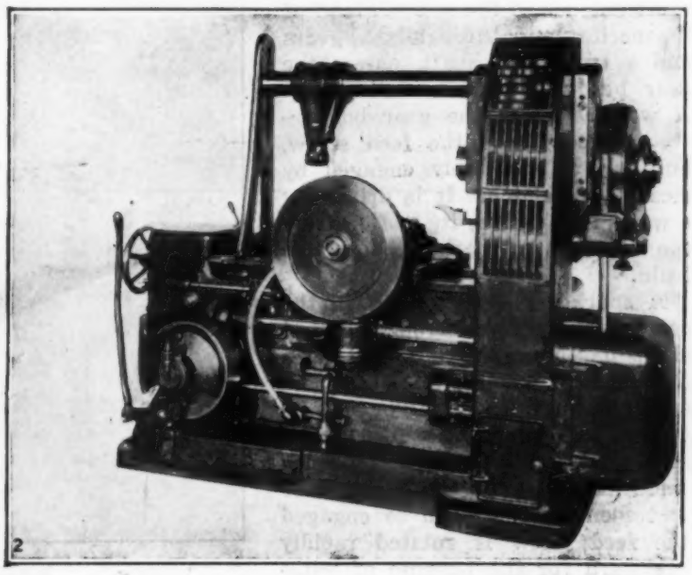


FIG. 1—BROWN & SHARPE NO. 34 SPUR GEAR HOBBING MACHINE. FIG. 2—REAR VIEW OF MACHINE

the worm may be dropped out of engagement with the wheel and the spindle turned rapidly by hand. The sleeve may also be disengaged from its shaft and the worm rotated by means of a small handwheel at the front of the machine.

The splined shaft at the rear of

FIG. 3—HOB DRIVE CASING ON BROWN & SHARPE MACHINE

the machine extends through to the indexing end of the machine and there drives a small pinion. This pinion drives the worm of the index wheel, a change gear train providing means for varying the relative rate of rotation between the hob and work carrying spindles, in accordance with the characteristics of the gear being cut by the machine. A hinged case also covers this train when the machine is in service.

From one of the members of the above-mentioned train of gears a shaft extends to the opposite end of the machine and, through bevel gears and a transverse shaft, enters the gear box at that end of the base. A wormwheel in the gear box revolves freely upon the feed screw, but may be positively engaged by means of a clutch. It is driven by a worm that derives its motion from the last member of the feed change train.

A spur gear, also located in the gear box, is driven from the first shaft of the machine and rotates continuously, whether any other part of the machine is running or not. It turns freely upon the feed screw also, and may be engaged by a reverse movement of the clutch lever just mentioned. When so engaged the feed screw is rotated rapidly backward for the purpose of withdrawing the hob carrier, and the speed of withdrawal is constant, regardless of gear combinations. The feed screw may at any time be moved in either direction by means of the hand wheel upon its outer end.

From the same original shaft is driven an oil pump which delivers lubricant to the various bearings of the gear box. Cutting compound is delivered to the cutter by a separate pump from a tank within the base of the machine, and the drive for this pump is such that the pump stops when the hob spindle is idle.

The machine will cut plain spur gears of 4 diametral pitch in steel and 3 diametral pitch in cast iron, up to 18 in. in pitch diameter. Any number of teeth from 6 to 50 may be cut, and any number from 50 to 180 except prime numbers. Hobs up to 5 in. in diameter can be used. A rim rest is provided for use when cutting the larger sizes.

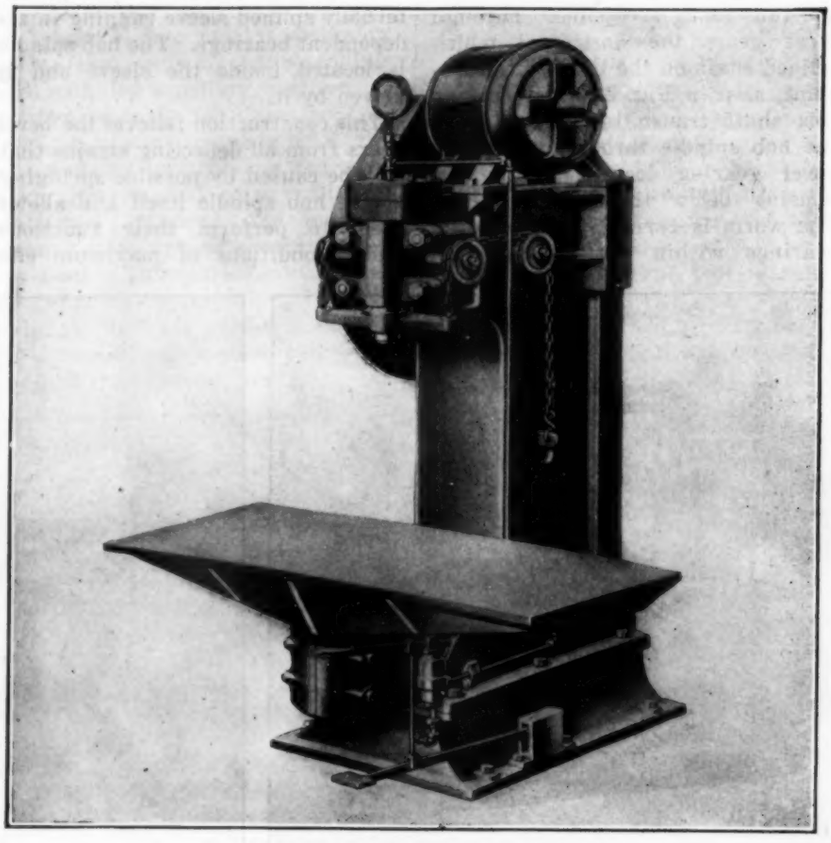
There are 10 speeds available for the hob spindle, ranging from 45 to 165 r.p.m. in geometric progression. Twelve rates of feed may be obtained, ranging from 0.025 in. to 0.153 in. per revolution of the work spindle. The machine occupies a floor space 50x103 in., and weighs approximately 6,000 pounds.

Watson-Stillman Hydraulic Press

The Watson-Stillman Co., 50 Church St., New York, N. Y., is now marketing a rapid-working hydraulic press for use in bending, straightening or forcing operations. Although the press is intended primarily for straightening camshafts, crankshafts and automobile front axles, it can be used for any work requiring pressures within its capacity.

The machine is a self-contained unit, requiring no auxiliary water or power supply, and is driven by a motor like any machine tool. It is quick acting and under absolute control by the operator through a valve, operated either by a hand lever or treadle. Both speed and pressure are controlled.

The pump is so arranged that the movement of the press ram through the idle portion of the stroke is rapid and the change from low to high pressure for the working part of the stroke is effected automatically. The whole table can be removed, leaving an open-jaw forcing press for general shop use in such operations as mandrel forcing,



WATSON-STILLMAN HYDRAULIC PRESS

bi'aching, force fitting and assembling.

The whole machine is substantially built and all working parts are inclosed by removable dirt guards. The frame is a steel casting and the copper-lined cylinder is bolted and keyed to it. The ram is made of high-carbon steel, and the cast-iron base serves as a reservoir for the pump.

The pump body is of bronze and the plungers are hardened tool steel, packed with hemp under bronze glands. All packings are accessible. The pump valves are of Monel metal and are the metallic-seated type.

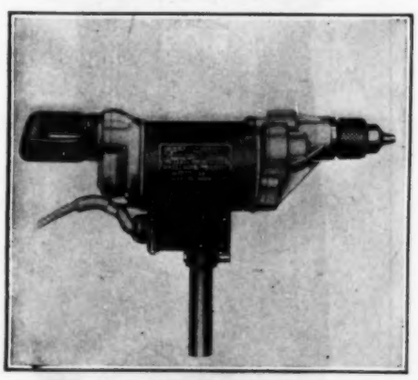
The ram has a positive stop to prevent overtravel and hydraulic pressure is used only for the pressure or downward stroke, the return being accomplished by means of a counterweight located inside the frame.

The press shown in the accompanying illustration is fitted with a slow-speed motor geared through a single reduction to the pump shaft, but a high-speed motor can be furnished with compound gearing. Spring-type centers can be furnished for holding work to be straightened, and these centers are adjustable for different lengths of work and table position.

Hisey 5/16-In. Side-Handle Drill

The Hisey-Wolf Machine Co., Cincinnati, Ohio, has recently placed on the market a side-handle electric drill of ⅝-in. capacity.

The tool is equipped with a universal electric motor which will operate on 60-cycle alternating current or direct current. Motors to run at either of two speeds, 1,250 or 1,475 r.p.m., can be furnished, the higher speed machine being especially adapted for wood and metal drilling in auto body and car building work.



HISEY ⅝-IN. SIDE-HANDLE DRILL

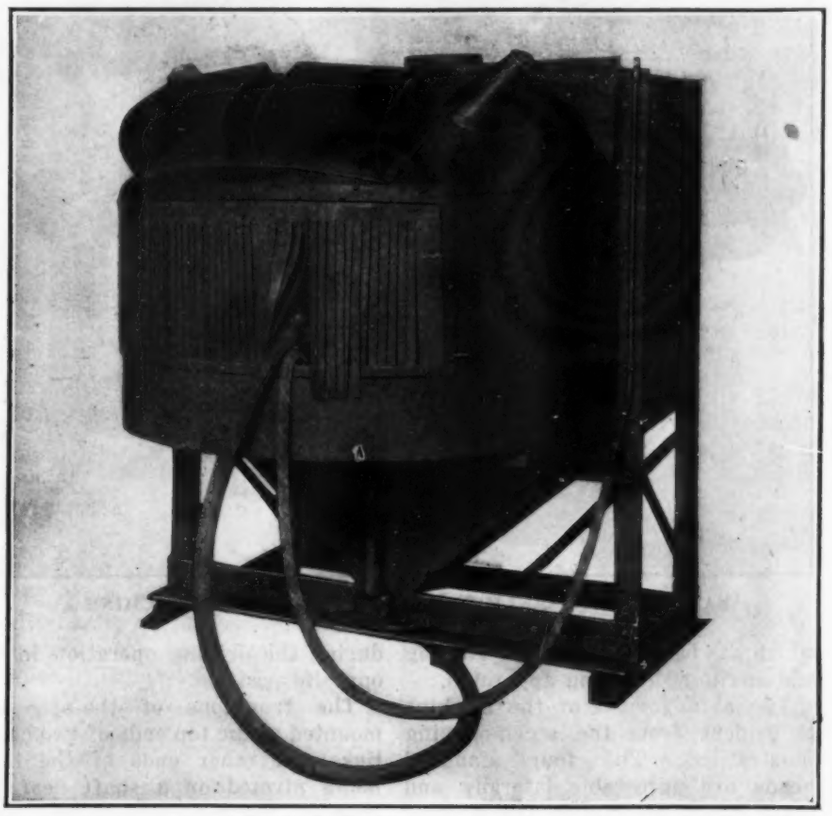
The tool is equipped with high-grade ball bearings throughout, and the gears are of steel, accurately machined and heat-treated. All bearings, gears and moving parts in the gear end of the machine are supplied with lubricant from the gear transmission case and the ball bearing on the top head is packed with grease.

The switch is conveniently located in the side handle, and a quick cable connector permits cable repairs and renewals without dismantling the machine. The usual cable and attachment plug are furnished, and a grinding wheel attachment with a 4½-in. wheel can be supplied. The Jacobs chuck will hold straight round shank drills up to ⅝ in. in diameter, and is standard equipment.

McLeod Sandblast Cabinet

A recent addition to the line of sandblast equipment manufactured by the McLeod Co., Cincinnati, Ohio, consists of an improved cabinet, fitted with a hand-operated revolving work table.

The machine is fitted with an injector type of nozzle to which are attached the air hose and sand hose, the latter being connected to a sand collector at the bottom of the sand hopper. From the collector the sand passes to the nozzle where it is mixed with the air and shot into the work at high speed.



McLEOD SANDBLAST CABINET

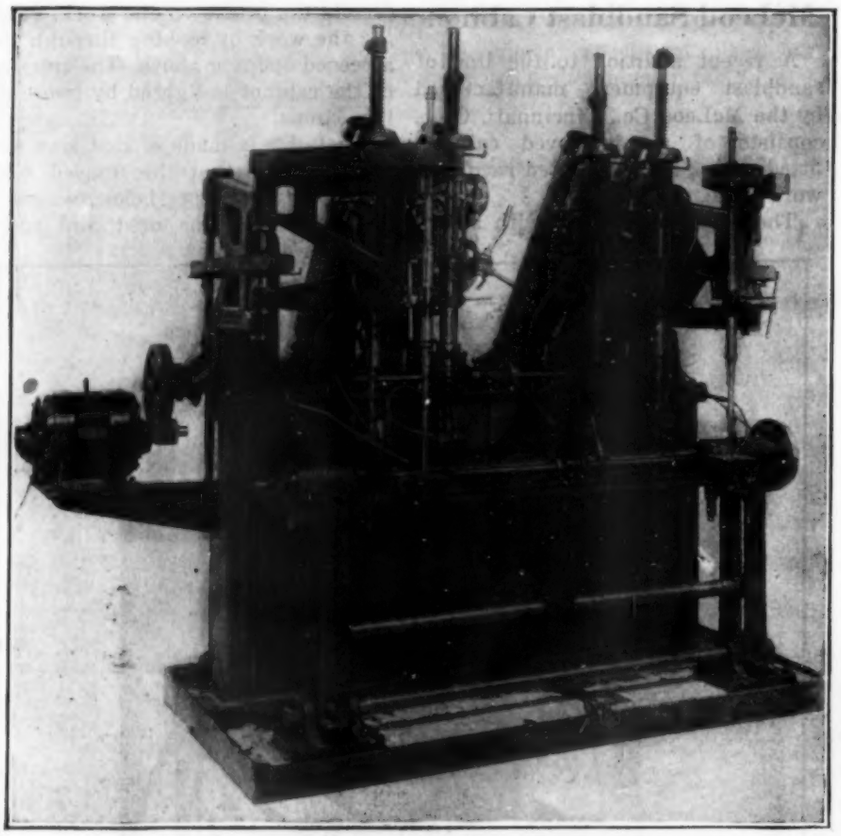
The cabinet is of heavy steel construction supported by angle iron braces. Through the slit rubber curtain, shown in the illustration at the front of the cabinet, the operator directs the nozzle on the work, guiding the work by looking through the screened opening above. The interior of the cabinet is lighted by two electric lamps.

The table is made of cast iron and is slotted, so that the unused sand falls into the hopper below, where it is reclaimed. The dust and spent sand is drawn off through the exhaust pipe at the top of the cabinet in the rear.

In the arrangement shown the castings are put in and taken out through the same opening, but the cabinet can be built with the opening at the other end and with half of the table extending outside. In such an apparatus the halves of the table are filled and cleaned alternately, allowing faster work by two operators.

Barnes Front Axle Drilling and Reaming Machine

The Barnes Drill Co., 814 Chestnut St., Rockford, Ill., has recently built a single-purpose machine for drilling and reaming automobile front axles. The machine consists essentially of a Barnes, 24-in., all-geared, gang drilling machine, previously described on page 466, Vol. 50, of the *American Machinist*, to which has been added a turn-over jig and auxiliary reaming apparatus.



BARNES FRONT AXLE DRILLING AND REAMING MACHINE

The arrangement of the machine is evident from the accompanying illustration. The four standard heads are adjustable laterally and these heads accomplish the drilling operations. Each one of the center pair is fitted with an auxiliary multiple-spindle head, so that the spring pad holes are drilled simultaneously at both ends of the axle. The two outer heads drill the king-pin holes, and all these drilling operations are done at the same time.

For reaming the king-pin holes, two radial heads are added to the machine and carry the reaming spindles. The reaming is done when the axle is in the outside position of the jig and while the drilling on another axle is being accomplished. The reamer goes through the hole in the opposite direction to the drill and, therefore, does not interfere with the drill bushing.

As soon as the reaming is finished the axle is removed and a new forging is clamped in the jig, the reaming and reloading being accomplished during the drilling operation in the opposite position.

The trunnions of the jig are mounted at the top ends of two heavy links, the other ends of the links being pivoted on a shaft near the base of the machine. These links allow the jig to be swung out bodily from the machine so that it will not interfere with the table as it turns over.

The swinging motion is actuated by an air cylinder, located on the machine base. Pressure on a pedal causes the cylinder to swing the jig outward, and after the jig is turned over, the cylinder draws it back again to the working position. It is said that the jig can be indexed in less than 10 seconds.

Quick, lateral adjustment of the jig is provided to bring the bushing guides to the centers of the bosses on the forging. The outer spindles are quickly brought to the centers of the bushings by the movement of a lever at the center of the machine.

It is stated that these machines effect a doubling of production over the old methods, due to the saving of the reloading and reaming time.

Merrill Improved Board Drop Hammer

An improved design of board drop hammer is now being marketed by Merrill Bros., Maspeth, N. Y. These hammers are built in sizes ranging from 600-lb. to 5,000-lb. falling weight, and the essential features of the machine are shown in the accompanying illustration.

The upright frames are I-section steel castings, keyed and bolted to the top of the base. Four holding bolts are used and, in connection with the lifter construction and the tie rods at the top, tend to prevent any rocking of the uprights on the base. The side thrust from breakdown work is taken by the keys and bolts of the fastening for the uprights in such a manner that failure at this point is almost impossible.

A feature of the machine is the

MERRILL IMPROVED BOARD DROP HAMMER

use of adjustable and reversible ram guides, fitted to the upright frames, and besides being reversible the guides have double Vs. The guide adjustment is simple and positive, and the guides can be dropped back into the uprights to allow the removal of the ram. By adjusting both the bottom and top guide wedges, the face of the ram can be squared up with the face of the shoe. When removed, the guides can be planed with comparative ease as they are but 5 ft. long on the largest hammers.

In the improved lifter mechanism, the arrangement of sliding boxes previously used is continued. To maintain the parallelism of the rolls, a compensating eccentric in one of the eccentric sleeves is provided, and the simple adjustment can be accomplished without removing any lifter parts. The hammer can be quickly adjusted to accommodate a very thick or very thin lifting board by changing the roll eccentric bushing.

The eccentric construction is such that when the friction bar falls, the rolls are practically locked, and this arrangement permits the use of a light friction bar, rolls the board more nearly straight, and prevents excessive wear near the pick-up point. The friction bar is made straight, with an eye at the upper end for attachment to the eccentric lever.

The roll releasing lever lifts the friction bar to its seat without shock or jar and permits as high speed as the lifting board will stand. The adjustment for length of stroke can be conveniently adjusted by the operator.

The clamp for holding the ram suspended is positively and easily operated by means of a special treadle. The clamps are placed under the rolls and are full-floating to conform to the position of the board. The complete clamp assembly can be removed without disturbing any parts of the lifter.

A simple and positive device has been provided to lock the treadle unless the operator places the foot upon a pad about 6 in. square. Unless a person is on the tripping pad, he can stand upon the treadle without tripping the ram. The pad can be adjusted to suit the operator, or can be entirely removed if it is desired to operate the machine in the usual way without taking advantage of the safety feature.

An adjustment for the die from front to back is accomplished by means of a taper insert in the shoe opposite the die key. This adjustment is positive and the die cannot get loose without the die keys coming out.

Garvin 3-Spindle Duplex Horizontal Drilling Machine

A recent addition to the line of machine tools manufactured by the Garvin Machine Co., Spring and Varick Sts., New York, N. Y., consists of a No. 1-S special 3-spindle, duplex, horizontal drilling machine. A front view of the machine is shown in the accompanying illustration, and it is designed for drilling, boring and reaming automobile steering knuckles.

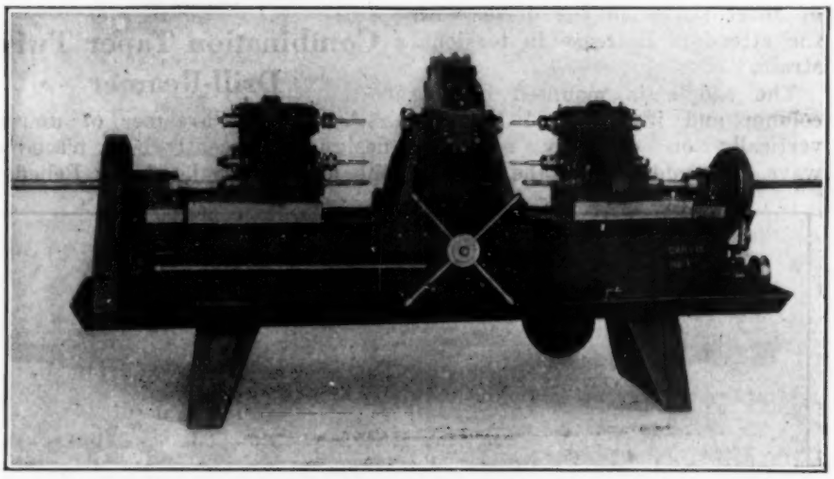
Two heads are arranged to slide longitudinally on the bed of the machine and each head carries three spindles. The work is held in a squirrel-cage fixture at the center and is indexed after each operation.

By means of the three spindles operations on three pieces are accomplished simultaneously. A $\frac{3}{4}$-in. hole is drilled in one, this hole is bored to $\frac{31}{32}$ in. in diameter on the next, and finish reaming to $\frac{7}{8}$ in. in diameter is done on the third.

The heads feed toward the work automatically, but are returned by the hand-operated pilot wheel at the front of the machine. The feed is thrown in as soon as the fixture is indexed, and it is said that the machine will finish one steering knuckle every 40 seconds.

Each head is driven independently by a 7½-hp. motor mounted on the machine at the rear. The power is transmitted through spur gears to the main driving shaft in the heads and all gears are protected by suitable guards. The work is flooded with cutting lubricant from a pump located at the right-hand end of the machine.

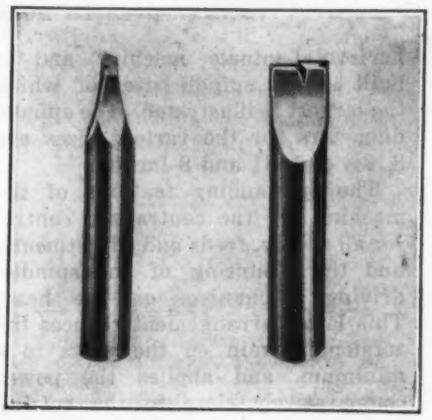
With the exception of the three-spindle heads and the squirrel-cage fixture, the machine is a standard product of the company, the addition of these parts making a high-production, single-purpose machine.



GARVIN 3-SPINDLE DUPLEX HORIZONTAL DRILLING MACHINE

Economy Cutters

The Economy Products Co., 50 Spring St., Newark, N. J., has recently placed on the market a line of high-speed steel cutters, especially adapted for cutting keyways, slots and oil grooves, facing, die slotting, the machining of flat-bottomed holes, and similar operations.



ECONOMY CUTTERS

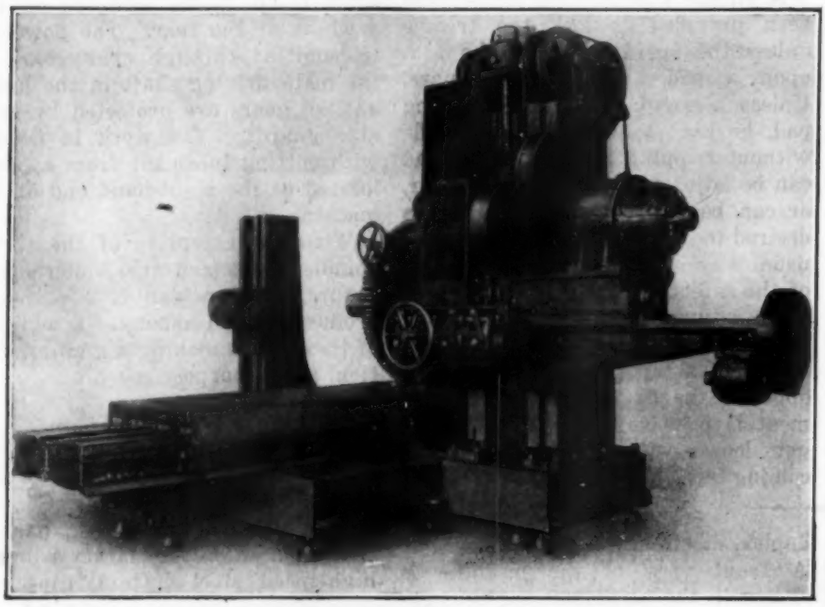
The feature of these cutters is the arrangement of the cutting edges as shown in the accompanying illustration. Two cutting edges are provided and the sharpening of the tool

is comparatively simple. Repeated grinding will not affect the diameter of the cutter. It is claimed that the design of the cutting teeth gives exceptionally free cutting action without in any manner imparing the accuracy of the surface produced.

These cutters are manufactured with straight shanks in diameters from ⅛ to ½ in. inclusive, and with taper shanks, from ⅝ to 1½ in. in diameter.

Beaman & Smith Horizontal Boring Machine

The machine shown in the accompanying illustration is now being marketed by the Beaman & Smith Co., Providence, R. I., and is adapted for drilling, boring, tapping and milling operations. It is a floor-type, horizontal-spindle machine and is built in five spindle sizes of which the largest is illustrated. The spindle diameters for the various sizes are 3, 3½, 4, 5, 6½ and 8 inches.



BEAMAN & SMITH HORIZONTAL BORING MACHINE

The outstanding features of the machine are the centralized control for all speeds, feeds and adjustments, and the mounting of the spindle-driving mechanism on the head. This latter arrangement reduces the torsional strain on the parts to a minimum, and applies the power comparatively close to the cutting points.

The feeding length of the 8-in. spindle is 4 ft., and the movement is accomplished in either direction by both hand and power. Rapid power traverse is also provided for quick adjustment. Eight feeds are available, ranging from 0.006 to 0.272 in. per revolution of spindle, in geometrical progression.

Ball bearings support the spindle end thrust, and wear adjustment is made by taper bronze boxes in each end of the quill. The quill is also mounted in taper bearings and carries the large driving gear. This cast-steel gear has a pitch diameter of 4 ft., and the teeth are 2 pitch.

This gear is driven from a motor mounted on the head, through gearing which gives a geometrical series of speeds for the spindle from 1¼ to 80 r.p.m. The position of the motor on the head permits the use of short shafts in the drive, with the attendant decrease in torsional strain.

The saddle is mounted on the column and is arranged to slide vertically on carefully machined ways. In addition to the binding bolts on the gibs, bolts are also provided for locking the saddle to the upright when heavy work is being done. The head is counterweighted, the weights being attached by wire cables running over pulleys at the top of the column.

The saddle has a length of travel of 44 in. on the column, and both hand and power feed, together with rapid power traverse, are provided. The power feed equipment for the saddle is furnished for milling operations.

The work table is 4 ft. wide and 10½ ft. long. It is provided with rapid power traverse and hand adjustment, and milling feeds can be furnished, if desired. The mechanism is mounted in ball bearings, so that the table is easily moved by hand, and the compactness of the apparatus allows the use of short shafts.

The bed for supporting the table is nearly twice as long as the table itself and is arranged to be adjusted along the platen by hand. A fine power adjustment can also be provided. This movement of the bed on the platen is provided for the purpose of bringing the work close to milling cutters or facing arms attached to the faceplate gear.

The outer support has adjustments to correspond to the spindle. Scales are placed in the column and on the table for alignment, and micrometer dials are provided for fine adjustments. The maximum distance between the faceplate gear and the outer support is 9 ft.

There are four motors on the machine; one for raising and lowering the head; one for driving the spindle; another for the quick power traverse of the spindle; and a fourth for operating the table.

Combination Taper Twist Drill-Reamer

A taper drill-reamer of unusual design has recently been placed on the market by the A. C. Bellefleur

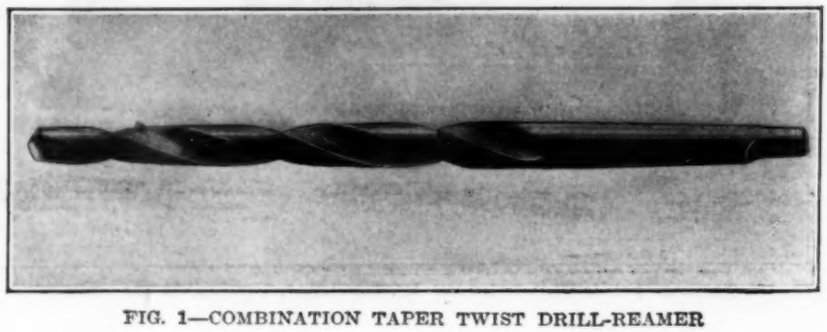


FIG. 1—COMBINATION TAPER TWIST DRILL-REAMER

& Son Co., 81 Hamilton St., New London, Conn.

The tool is designed to drill and ream taper holes in solid material and is illustrated in Fig. 1. As shown in Fig. 2 one edge of each flute of the tool is provided with cutting teeth which cut the taper and ream the hole. It is claimed that taper holes can be produced in the same manner that straight holes are made with an ordinary drill.

The standard taper is ¼ in. per ft., and both taper and straight shanks can be furnished. The maximum diameters of the tools range from 0.103 to 0.755 in. Special tapers, sizes and lengths can be furnished.

The advantage claimed for this drill-reamer is the saving of time by its use, one operation completing the drilling and reaming of a taper hole, while three are required when using the ordinary straight drill and reamer.

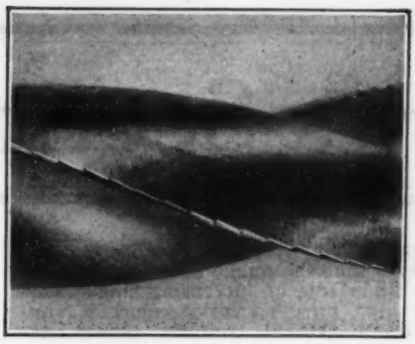
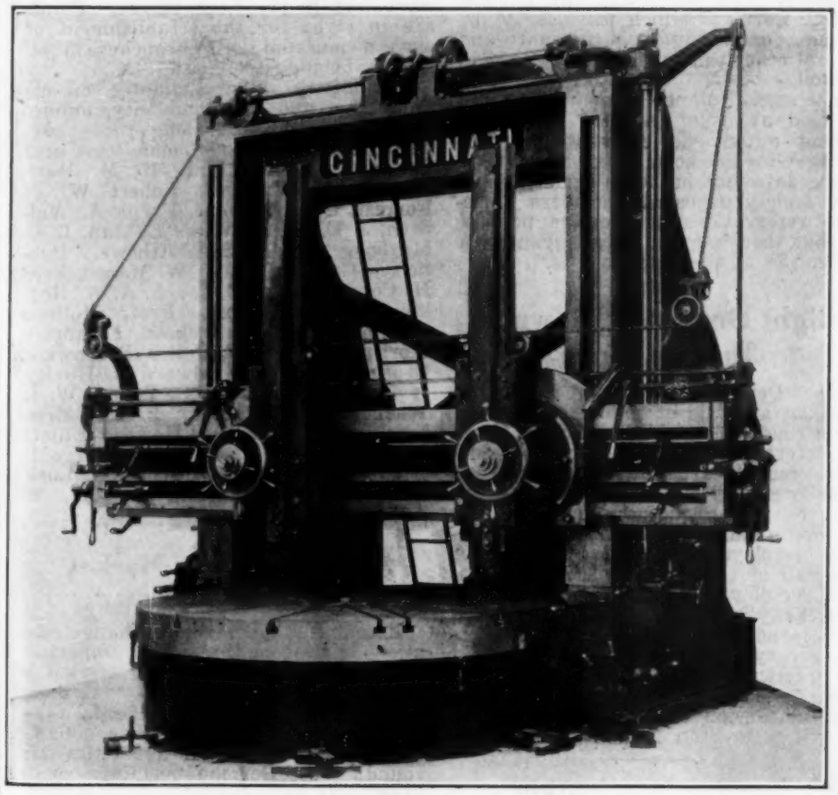


FIG. 2—CLOSE VIEW OF TOOL SHOWING REAMING TEETH

Cincinnati 8-Ft. Boring Mill

A recent product of the Cincinnati Planer Co., Cincinnati, Ohio, is a special 8-ft., massive, boring mill, in which many improvements in design have been incorporated.



CINCINNATI 8-FT. BORING MILL

A large bevel gear is bolted to the table and is driven by a pinion. The pinion is supported on both sides and is a separate unit from the gear box. The upper spindle bearing is made adjustable in order to compensate for wear.

The drive gear box provides four speed changes when a variable speed motor is used, a box which will give nine speeds being furnished when a constant speed motor is installed. All the gears are made of steel, the shafts are of high-carbon steel, and the bearings are bushed with bronze.

The motor is mounted on top of the gear box and is geared to the drive shaft. The speed change levers for changing the speed of the table are conveniently located at the side of the operator.

The housings, which are exceptionally high, are bolted to the base extensions. In addition they are doweled and tongued into the base at the bottom, and tied together at the top by a heavy box-section arch. This construction tends to eliminate vibration and a cross-brace is also used to add to the firmness of the housings.

The heads are of a special design. The handle wheels are equipped with a hand feed and lock, so that the operator can feed and lock without undue exertion. The rams are of extra length and the feeding racks are of steel and bolted to the rams. This construction allows replacement of the racks.

The feed and rapid traverse are controlled from the side of the head so that the control levers are within reach when using the head in the center of the table. Sensitive handles are provided to allow setting of tools.

The feeds are obtained through a gear box in which all gears are of steel. Eight feeds are available and the box has a vertical tumbler arrangement which automatically locks itself when placed in a correct position. The matter of centralized control has received particular attention, and the design of the machine is such that the operator can conveniently reach all the levers required to control any operation.

The rail is raised and lowered by an elevating device which is driven by positive clutches, and in which is a friction clutch incorporated for safety. When the rail is raised beyond its maximum height, an automatic stop automatically throws out the clutch.

Copy of Patent Laws for Japan

Through arrangements with the Secretary of the Interior, a complete set of the Official Gazettes of the Patent Office containing all patents issued by the United States Government will be furnished to Japan.

Destruction of a magnificent new Patent Office completed by the Japanese government in January, 1923, by the earthquake with the loss of all the files of patents issued by foreign governments, including the United States, led to a request for a new set of records by the Japanese Ambassador at Washington.

The plans of the Japanese government provide for the immediate construction and operation of a new Patent Office.

News Section

Architects Approve Brown Plan

The American Institute of Architects, it is announced, will join with the Federated American Engineering Societies and other allied organizations in a nationwide movement to bring about the reorganization of the Department of the Interior as provided in the Brown Plan, which was approved by the late President Harding.

Milton B. Medary, Jr., of Philadelphia and Thomas R. Kimball of Omaha have been appointed to represent the Institute at the Public Works Conference to be held under the auspices of the Engineering Federation in Washington on Jan. 9. The question of public works was described as one of the most vital before the Institute, which took a leading part in the effort started several years ago to eliminate waste in the Federal Government through reorganizing departments and bureaus. More than 200 organizations, including representation from contractors, will send delegates to the Washington conference.

The plan supported by the Institute and the engineering societies carries out to a greater or less extent the recommendations previously made by these bodies. Practically all the construction work now scattered through some thirty or more departments and bureaus is to be combined in a new bureau of Public Works under the Interior Department.

If this plan is approved by Congress, the work of the Supervising Architect's office will be transferred to the Interior Department and come under the Division of Public Works.

Gives Information on Apprenticeship

An encyclopedia of information on the subject of apprenticeship in the United States is now available in the Bulletin on Apprentice Education that has just been issued by the Federal Board for Vocational Education.

New methods of apprentice training have been made necessary by the introduction of large scale production in industry, the Bulletin shows. During the last fifteen years, we have witnessed the development of the class room method of apprentice education to supplement job experience. Such education has arisen, either in the form of vocational training in the public schools, or through corporation schools under the auspices of employers, or through classes controlled by the trade unions.

The most surprising progress has been made along the lines of part-time apprentice training classes organized by the public schools, according to the Bulletin. Such training dates from the passage of the Federal Vocational Education Act in 1917. At the close of the fiscal year 1921-22, a total of 265,494 pupils were enrolled in such continuation classes. The Bulletin believes that the public school is destined to fill a rôle of increasing importance in apprentice education, since it supplies a neutral training agency, acceptable to both capital and labor.

Three S.A.E. Events in January

The Society of Automotive Engineers is calling attention to the three big events that it will hold during January. Contrary to the custom of previous years, the annual meeting of the society will not be held in New York City during automobile show week, but in Detroit, Jan. 22 to 25, during the Detroit show week. Detroit is described as the geographical center of the society membership and the heart of the automotive industry. On Jan. 23 will be the S.A.E. Carnival which promises to be unique, extraordinary, unusual and several other things. It will be held in Detroit.

The annual dinner of the society will be held as usual in New York City during automobile show week. The Hotel Astor has been chosen and Jan. 10 is the date that has been decided upon. The society urges all members to secure reservations as soon as possible so that there may be no annoyances or difficulties at the last moment.

Slight Decrease Shown in Employment

The Department of Labor reports that an analysis of industrial employment conditions in United States, based on information gathered in 65 industrial centers from 1,428 firms, each usually employing 500 or more workers, for the month ending Nov. 30, 1923, showed a small reduction in total numbers employed, amounting to 0.5, or one-half of 1 per cent of the total number employed by these firms on Oct. 31. Two of the outstanding factors responsible for this decrease were temporary curtailment of employment in practically all large railroad centers during the month of November, and the suspension for a short period of activities in iron and steel.

Burgess Nomination Is Approved

The presidential nomination of George K. Burgess to be director of the Bureau of Standards was confirmed by the Senate on Dec. 18. The Senate also confirmed the nomination of C. L'H. Ruggles to be assistant to the Chief of Ordnance with the rank of Brigadier General and of John W. Joyes to be assistant to the Chief of Ordnance with the rank of Brigadier General, and of Samuel McRoberts and John R. Delafield to be Brigadier Generals O.R.C.

Industrial Museum Meeting Held

A meeting of the organizing committee of the National Museum of Engineering and Industry was held in the council room of the A.S.M.E. in New York City on Dec. 20 with an excellent attendance. Acting Secretary H. F. J. Porter presided.

The active work looking toward the formation of this museum had its beginning in 1918 in the efforts of the Delameter Iron Works Veterans, the Marine Architects and Naval Engineers, and the Society of Swedish Engineers who later honored John Ericsson by erecting four tablets at various parts in New York and Brooklyn as was chronicled at the time.

It is expected that the four large engineering societies will endorse the movement in the near future. Funds are in sight for the establishment of such a museum with branches in all important industrial cities.

Committees were appointed on organization and plan, publicity, finance and membership. Among those suggested for the various committees are: Organization and Plan—E. M. Herr, Thomas W. Lamont, Robert W. de Forrest, Gerard Swope, Frank A. Waldron, J. E. Sague, Willis E. Hall, L. C. Marburg and E. S. Matthews. Publicity—George Iles, W. W. Macon, Fred H. Colvin, Henry G. Leach, A. A. Hopkins, James Creese, Prof. Holland Thompson and Luis Jackson. Finance—Mortimer L. Schiff, Julius Rosenwald, George E. Roberts, Edward N. Hurley, Irving T. Bush, Owen D. Young, W. R. Warner and George D. Pratt. Membership—Charles Piez, Howard Elliott, D. S. Simpson, A. J. Poole, George F. Kunz, Bion J. Arnold, George I. Lockwood, Samuel Vauclain and W. W. Atterbury.

The Machinery Market in Italy

Recent changes in the exchange situation in Europe have had important influences on the machinery market in Italy, according to a report dated Nov. 3, from H. R. MacLean, Commercial Attaché, Rome. The collapse of the mark and other difficulties surrounding the German machinery manufacturers have caused the Germans to submit their quotations in the Italian market in United States dollars or British pounds sterling, with the result that German prices are now above the Italian level, and Italian machinery manufacturers have thus secured an increased volume of business.

American machine-tool manufacturers still find business difficult because of competition from Italian and other manufacturers. At present Swedish prices appear to be particularly low, production costs in that country being light.

Detroit Preparing for Coming Year

With the holiday season at hand, Detroit's manufacturing plants are going through their annual counting up of assets preparatory to beginning the year 1924 with capacity production.

Leaders in the machine tool industry declare that the outlook for the next year is brighter than they have known in some time. This year is pointed to as being the closest approximation to a normal year that the industry has experienced in some time. The immediate pre-war years, the war years, and those following were featured by periodic rises and falls, with abnormal conditions that mitigated against the chance for a normal business.

Reviews of this year are based upon the fact that 1923 was a normal year, and forecasts presume that 1924 will be another such year.

The automobile plants are counting up their assets, now of record total, and their executives are casting an interested and confident eye toward 1924 and the national automobile shows, the first of which opens in New York on Jan. 5.

Surprising are the employment figures for the week as announced by the Detroit Employers' Association. The figures show 219,155 employed this week, an increase of 2,025 over the 217,130 of last week. Employers point to these figures as furnishing sufficient indication of what may be expected with the beginning of 1924.

Changes in executive personnel throughout the automobile industry during the last six weeks provide an additional ground for the assertion that "keen competition" will be felt 100 per cent next year. Executives are attempting to bolster up their departments wherever possible in order to meet the competition from other producers in the same price fields.

The general belief that consolidations of motor companies are inevitable is leading to strenuous efforts on the part of every manufacturer to be in a strategic position if such consolidations take place.

Building statistics continue to break all records, and with important announcements of other factory additions ready to be made within the near future.

Overland Production Increased

Willys-Overland plans to produce $250,000,000 worth of automobiles during 1924. President John N. Willys announced that, according to contracts already on file with practically all of the Willys-Overland branches, distributors and dealers throughout the world, Willys-Overland production will have to exceed 300,000 cars to take care of the apparent demand.

As the initial step toward the fulfillment of these orders, Mr. Willys has further announced a curtailment of the annual inventory period, which began Dec. 17. In previous years this work has always taken until after the holidays, but this year instructions have been issued that the work must be speeded up so that the wheels of production will be turning again by Jan. 1.

During 1923 Willys-Overland's production amounted to more than 200,000 cars, doubling last year's output. With the 1924 demand anticipated, Mr. Willys has been in constant conference with the factory organization regarding plans that will permit a resumption of activities following the curtailed inventory period on a much greater scale than ever attempted previously.

News of Washington Activities

By Paul Wooton

With the approach of the first of the year, attention in the coal industry is turning to the new wage agreement. While the United Mine Workers have had little to say as to what demands they will make, it is very apparent that they are not particularly belligerent. With 76,000,000 tons of coal above ground; with 10,000,000 tons more at the head of the lakes than in any other year and with half the union mines down thus early in the Winter, there is certain to be less insistence on increased operating expenditures. Such expenditures could do nothing more than close the mines and divert further business to the non-union fields.

There is a tendency to compare the existing situation with that which preceded the last strike. There are some resemblances but, in the main, the situation is importantly different. The inclination of the market is in the same direction, but it has not gone so far. The state of general business is much better. Between 10,000,000 and 11,000,000 tons of coal are being produced weekly, whereas production during the corresponding period preceding the last strike was running some 3,000,000 tons lower. Relations between operators and mine workers are nothing like as strained as they were then. There is not the same tendency to cut wages in the non-union field.

While the demands of the mine workers cannot be forecasted, it is apparent that the differences which will arise at the forthcoming wage conference will not be of the same pronounced character as were those preceding the present agreement. The consensus of opinion is that there will be no strike and that the conferences will not be the occasion for any great amount of uncertainty among coal consumers.

Japanese Orders

Orders aggregating $200,000,000 have been placed in this country by the Japanese since the earthquake. The great bulk of all orders placed by Japan has come to the United States. While a portion of this business reflects Japan's appreciation for the aid extended by this country at the time of the disaster, it is thought to have been influenced mainly by the willingness of American manufacturers to quote pre-disaster prices. In other countries bids reflected the sharp advance in materials which came with the anticipation of the Japanese demand.

Despite the large orders that have come to this country, it is recognized that no permanent value grows out of destruction. The effect of the Japanese earthquake will be felt over a long period in its having reduced the consuming power of the people of that Empire.

American Trucks Favored in Japan

The recent disaster in Tokyo and Yokohama has resulted in a marked stimulation of business in automobiles, especially trucks, according to Commercial Attaché, J. F. Abbott, who is at present on leave in this country. American manufacturers, however, should not build their hopes too high on the initial orders that have been received. The Japanese are inveterate speculators, and the suspension of the duty on trucks until April has naturally led to an attempt to stock up. On the other hand, the experience of the past few years with the lighter European cars has convinced the Japanese consumer of the ultimate economy and superiority of American cars, and the market is bound to expand steadily. It is limited not only by the very poor character of rural highways, which restricts trucking at present to the large cities, very few in number, but as well by the very high operating cost of trucks that still permits effective competition on the part of handcarts.

Gain Shown in Week's Car Loading

Loadings of revenue freight for the week ended Dec. 8 totaled 913,774 cars, an increase of 4,600 cars over the corresponding week of 1922, according to the figures of the American Railway Association. This also was an increase of 78,478 cars over the previous week, when there was a sharp decline, due to the Thanksgiving holiday.

The Western district again led with an increase of 5⅔ per cent over the corresponding week of last year, while the Eastern district reported a 3 per cent increase and the Southern district 1 per cent.

The loadings of Dec. 8 bring the total for the year to 47,425,760 cars, as compared with 40,797,973 cars in the same period of 1922, and 37,401,923 cars in 1921.

Merchandise and miscellaneous loadings, generally considered the criterion of business conditions throughout the country, showed a decided gain. With a total of 227,038 cars, merchandise shipments were 18,841 greater than in the same week of 1922.

Cost of Living Takes Slight Rise

The cost of living in the United States on Nov. 15, 1923 had increased seven-tenths of one per cent over the level of Oct. 15, 1923 as shown by figures just collected by the National Industrial Conference Board in a comprehensive survey of conditions the country over. The increase since last July was 2.1 per cent. In the month from Oct. 15, 1923 to Nov. 15, 1923, there were increases in the average cost of food and sundries. Average rents advanced, but the cost of clothing, coal, gas and electricity were lower. Between July, 1920, when the peak of the rise in the cost of living since 1914 was reached, and November, 1923, the cost of living decreased 19.2 per cent. The increase since July, 1914 was 65.3 per cent.

Cleveland Makes Elaborate Plans for Increased Business

Little new machine tool business is now expected for domestic uses until after Jan. 1, and a general going over at local plants now is in order, both mechanically and commercially.

These plans are being made to keep pace with the better prospects in industry generally, in spite of the re-adjustment that seems at hand. For example, not a little faith is placed in the reports that have been seeping into this market in the last few days relative to the possibility of Akron, only 30 miles distant becoming the airplane, as well as the American Zeppelin center of the country. These rumors are based upon the negotiations of financial interests identified with the Goodyear Tire & Rubber Co. to acquire the Curtiss patents and plant at Dayton and to remove the plant to Akron. The Zeppelin plant is expected to start operating early in 1924. This is the second report coming to general manufacturing circles here recently, and bears the earmarks of probability since some Goodyear executives have admitted they, too, have learned of the move, something that did not exist before this time.

Meanwhile the automobile industry in Cleveland and nearby cities in placing orders for raw materials in fairly liberal quantity, though here also the new business is tempered by the belief that steel materials will be lower. In the main the larger producing automotive factors are apparently going ahead with their early 1924 program.

In this connection, a favorable reflection in new railroad business is seen, with the possibility of more new rolling stock to be added by the various carriers serving this district in the transportation of new automobiles during the first two months of 1924. Shippers in the Great Lakes region are shaping their plans to provide some 26,000 cars in January and 30,000 cars in February for this purpose alone.

A specific instance is cited by President Chandler, of the Chandler Motor Car Co. of Cleveland, which already is preparing to place orders for new material with which to build additional quantities of its product during the first quarter of the new year. Reports gathered by this firm alone indicate that its sales organization is working now for an outlet in excess of the same period a year ago in Chandler cars.

While no hint as to the addition of new equipment is heard, the need for machinery with which to improve its present rolling stock by the Nickel Plate road offers encouragement also. During the three months beginning Sept. 1, this road cut approximately in half its unserviceable engines and made a like reduction in unserviceable cars. A similar gain is shown by the Chesapeake and Ohio R.R., both moves being largely to expedite the increase in Fall freight traffic.

Some Sales Made in New York

Some sales of single tools were consummated during the week in the New York market, the orders coming from unexpected sources. According to the reports, several general industrials needing a few new tools have been waiting until this time when things were quiet before making the purchases, and this week closed on enough small orders to make a fairly good showing for several of the larger dealers. In addition to this, here and there were the reports of sales to railroads, but nothing of importance nor of significance, in as much as most railroad buying will go over until after the new year.

Nothing has resulted from the automotive field in several weeks, but inquiries are said to be coming into the New York market from this source and spirited buying is anticipated after the year has been started.

In the used tool field some little encouragement was found in the Southern sales consummated in the New York market. There were also some sales made to Philadelphia industries in the Metropolitan district. Some complaint was expressed by dealers on their inability to pick up reasonably tools in good condition.

Many of the dealers in the East are taking advantage of the December lull to take inventory and to add up the profits and losses for the year 1923. Stocks are found to be low in warehouses in nearly every case and, except for standard lines, very few machines can be found awaiting buyers. The stocking-up process will commence during the middle of January, according to the dealers.

Export business is better, according to authorities in that line, and the month of December has kept up remarkably well after November which was a particularly good month.

Cincinnati Reports Good Month

There is an encouraging tone to business in the machine tool industry of Cincinnati, despite the fact that the usual seasonal decline due to the Chirstmas holidays is at hand. While it cannot be said that the machine tool houses are doing a big business, the orders that have been coming in are holding production up to a level that promises well for the future. The machine tool industry in Cincinnati, taken as a whole, has experienced a far better year during 1923 than during 1922. While the volume of orders received in the first six months of 1923 was greater than in the last half of the year, the past three months have seen a more active market than the same period of last year. Some plants say that their orders for November were ahead of those for October and that the first weeks of December were on a par with last month. Others report that the latter part of November saw a drop in their output and that December business has been slightly below that of October and November. A general survey of the market, however, will show that November production rivalled that of October, while the first two weeks of December were most encouraging with sufficient orders coming in to keep plants operating on about the same scale as they did through November.

The morale of the industry is better than it was a short time ago. There is a distinct note of encouragement in the way that machine tool men talk. One of the largest plants in the city states that its business this month has been ahead of November. Others report that the condition of the market is very good when the season of the year is borne in mind.

Many Inquiries

Many Cincinnati manufacturers report that their inquiries have been numerous. Buying of machne tools by the automobile manufacturers has fallen off to some extent, but is still of large enough proportions to be a considerable factor in the present market. It is unlikely that there will be much active purchasing by the automobile industry until after the first of the year. Railroads have not been in the market to any appreciable extent lately, but it is thought that there will be some good business placed by railroads possibly before the end of the month.

Planer manufacturers state that their volume of business has held up practically to the same level as during October and November. They are optimistic and say that a healthy number of inquiries are being received daily while orders are satisfactory. The orders for planers are not coming from any particular source, but the industrial field in general is buying in fair quantities. Orders for milling machines and lathes have decreased somewhat in the past two weeks and it is not likely that there will be any change in the market for these two products until after the opening of the new year.

Orders for electrical tools have maintained a good standard in the past two weeks. The electrical tool houses in Cincinnati have been kept busy all through the Fall season, while the early days of the present month showed no decline in activities. The approach of the holidays, however, is being felt and business will slacken up until after the first of the year. Conveying machinery houses are still producing at a normal rate and report that they have many orders on hand to keep their plants running on a full time schedule. There has been but little change in the woodworking machinery plants where production has been exceedingly heavy for the last two months.

Business Improves in Philadelphia

Dealers in small tools in Philadelphia reported business conditions more satisfactory this month than is usual in December. Those engaged in this line of the trade find a number of small shops purchasing their equipment in anticipation of an increase in the volume of business after Jan. 1.

There has been a demand for single lathes and drills for small shops. Business has shown a marked improvement in December over November and October.

Philadelphia manufacturers of gears also report a satisfactory business. The

orders are well distributed and inquiries are coming to manufacturers in normal volume. There was nothing in this line to indicate a lull in the immediate future.

Manufacturers of woodworking machinery report a falling off in their production. This is seasonal and was expected, manufacturers and dealers said. They are awaiting general business developments which will indicate whether next year's building activities are to be as great as those of 1923. Inquiries are being received which leave a hopeful feeling.

Pennsylvania is on the threshold of a great development in the construction of electric power equipment. Eleven large stations are under construction and will be finished by the end of 1925. Eight of the new stations will be operated by steam and three by water power. The largest of these installations will be at the foot of Erie Ave., where the Philadelphia Electric Co. will build a plant having an initial capacity of 200,000 kw. which will ultimately reach 600,000 kw.

A general trend away from the restricted buying that has been the rule for a few months in the machinery and machine tool line is noted by some of the largest manufacturers. Many industries which heretofore have withheld purchasing until new orders were in sight now plan to reverse their former policy and buying on a considerably larger scale is anticipated.

News of European Iron Markets

Since the Armistice, Commercial Attache C. L. Jones cables the Commerce Department, French pig iron output for the month amounted to 514,230 metric tons and raw steel 476,696 tons. Each show an increase of approximately 7 per cent over the figures for September, or 482,000 tons and 446,000 tons. The figures are also about 25,000 tons above the previous record months of the year and increase the monthly average to 419,900 tons of pig iron and 395,900 tons of raw steel for the first 10 months of 1923. Of the total French output for the month of October, Lorraine contributed 181,841 tons of pig iron and 150,537 tons of raw steel.

AUSTRIAN IRON AND STEEL PRODUCTION

The October production of iron ore in Austria, according to the latest report from the Alpine Montangesellschaft—the leading unit of the Austrian industry—was 128,421 metric tons; pig iron, 25,271 tons; steel ingots, 32,247 tons; and rolled products, 20,282 tons. These compare respectively with the September production of 114,000 tons; 29,000 tons; 31,000 tons; and 22,000 tons; and with the monthly averages for the first 9 months of 1923, or 99,119 tons; 29,493 tons; 26,218 tons; and 19,114 tons. While the German demand for Austrian iron has ceased, other inquiries received brought the unfilled orders up to 36,496 tons, compared with 39,000 tons at the end of September, and the monthly average for this year of 33,811 tons. Prices of bar and hoop iron showed a slight increase, pig and rolled products were reduced, while structural iron remained unchanged.

South Enjoys Excellent Business with Bright Prospects Ahead

Though machine tool sales in the Southeastern territory are substantially on the same basis as they were two weeks ago, dealers in Atlanta and other important distributing centers of the district are growing more optimistic daily over the 1924 outlook. Inquiries for tools and equipment that will develop into orders during the early part of the coming year are considerably larger than they were at this time a year ago, with the principal activity still being shown by the railroad companies in the various Southeastern states, and a marked improvement in inquiries from the textile industries over the whole South. There are also signs of increasing activity on the part of the smaller machine shops in districts where agricultural conditions are satisfactory, and this source is expected to develop a fairly good volume of machine tool business during the next three or four months as the smaller shops have been doing comparatively little buying since early Fall and must shortly be in the market again to some extent at least.

Inquiries from the railroad companies are for heavier tools, largely for general shop equipment, and indicate that the railroads are contemplating some rather extensive purchases within the next few months for information, prices, etc., are being asked for on a large amount of such equipment. One company, in fact, has sent out inquiries for equipment amounting to considerably more than $100,000, and, it is understood, this same company is expecting to invest around a quarter of a million by the middle of the year. Therefore, dealers of the Southeast are giving considerable of their attention to this field at the present time.

The textile industries, more or less inactive for the past five or six weeks due to the uncertainty of cotton goods prices because of rapidly increasing cotton prices, are dispatching inquiries on a fairly active basis again, and dealers are looking for this field to develop a good volume of machine tool business during the first half of the coming year. The cotton situation is more stable than it has been for several weeks, and there is a certainty of active operation by the textile industries for some months.

Total sales in December will be about the same as they were in November, according to present indications, which will make the month about 10 to 12 per cent better than December of last season.

Another field expected to prove a good one in the next few months is the automotive service field, as stations in the South have been doing more business during the past three or four months and are showing a tendency to return some of the profits to the business in the purchase of equipment. Inquiries from this field are quite a bit more active than at this time last year, and many of these inquiries are expected to develop into orders after Jan. 1, 1924.

Regarded as a whole, the outlook is entirely satisfactory, with nearly all dealers optimistic. The early part of 1923 developed an excellent volume of machine tool business in the South, but most dealers state present indications portend an even better business during the early part of the coming business year.

Quiet Week in the Chicago Market

Machine tool dealers in the Chicago district had a comparatively quiet week and do not look for any material change until Jan. 1. Some of the industrials and a number of railroads are expected to do considerable buying.

The Atchison, Topeka & Santa Fe Ry. has entered the market for a 20-in.x10-ft. engine lathe. The Chicago, Burlington & Quincy R.R. is reported to have purchased a 40-in. car wheel borer. The Illinois Central R.R. has placed an order for a 800-lb. steam hammer with the Illinois Steel Co. The Norfolk & Western R.R. has purchased about 25 tools. The Minneapolis & St. Louis R.R. has entered the market for three engine lathes. The Union Pacific R.R. is inquiring for five engine lathes, three bushing presses, one link grinder, three upright drill presses, two 42-in. boring mills and three sensitive drills.

The Pettibone-Mulliken Co., Chicago, has purchased four radial drills, three tool grinders, eight engine lathes and three 28-in. shapers.

The Board of Education, Chicago, has purchased ten 12-in.x5-ft. motor driven lathes, one 10-ft. power brake, one 16-in. back geared crank shaper and a 20-in. tool grinder.

Railroads are coming into the market for cars and other equipment and indications are that activity from this important source will continue. The Standard Steel Car Co. has taken an order for 500 box cars for the Ann Arbor R.R. The Sinclair Refining Co. has purchased 18 standard gage tank cars from the Kopler Industrial Car & Equipment Co. Bids were taken by the Southern Pacific R.R. for about 10,000 cars.

The output of the leading steel interest in Chicago is around 80 per cent of capacity. Nineteen of twenty-seven blast furnaces are active, and it is possible that more will be added before the turn of the year. Operations of the leading independent continue to hover around the 75 per cent mark.

Safety Meeting Held in Baltimore

With more than 800 superintendents, foremen and others representing Baltimore's machine shops and other industrial plants on hand, the Baltimore Safety Council opened its series of safety conferences for foremen on Dec. 14. The speaker of the evening was John A. Oartel, director of safety for the Carnegie Steel Co., Pittsburgh, who spoke on how to obtain 100 per cent safety in industries.

The Industrial Review

What the year has yielded and some predictions for next year's production

TOTALS for the year 1923 in the machine tool industry are generally estimated as being from twenty-five to thirty per cent ahead of last year, and in nearly every part of the United States reports show that business is steadier this December than it was last December or the year before that. "War stocks" have almost entirely disappeared from the market, industries that use a large number of tools in a year are in a better position to buy them, production figures show an expansion that is natural and healthy and in no way related to war-time inflation, and prospects for the coming year are uncommonly bright.

The month of December proved to be a dull one with little buying in any of the markets of the United States. But the month of December is not expected to show big returns or substantial gains so, while it may frankly be said that business was poor, it can as frankly be stated that there is no disappointment. By comparison with last year, business is better in two ways. The actual number of orders is greater and the number of inquiries is far in excess of December, 1922 It must be confessed that hopes are built rather high by the machine tool builders and dealers when they view the possibilities of next year. Predictions say that automobile production will be greater, railroad buying will be as good as this year, exporting—including Japan—should prove very good, textile making is due for better times, and general industrials are all on the list of improvements for the coming year.

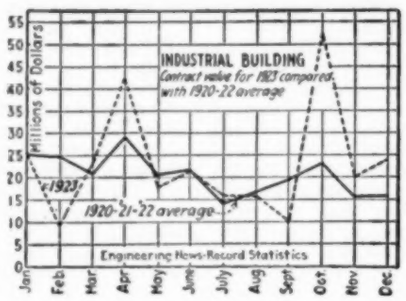
Recent reports from the various centers of the United States show that decided improvement has taken place in the Buffalo territory, Chicago has been able to sell some railroad requirements, Milwaukee machine tool builders are dividing their time between a fair volume of production and inventory, Cincinnati and Minneapolis have no complaint considering the season, Philadelphia, New York and Cleveland report a falling off in sales, but a gain in inquiries, Pittsburgh has been fairly steady, and New England is still "spotty."

Electrical Field.

According to reports received from the leading electrical market centers of the United States, there is an increasing unevenness of conditions as the year end approaches, and the present trend toward quickening of retail distribution and slackening of demand in most primary channels is a familiar occurrence in all commodity lines. Orders in the manufacturing and jobbing houses are largely deferred as attention is diverted to inventory taking, and the fact that increased operations have developed with many electrical manufacturing companies merely illustrates the contrasts which still mark the situation.

Holiday buying, of course, continues to take almost the entire attention of the trade, although there is much activity in the wire, lamp, wiring devices and motor markets. In New England the state of business is described by saying that retail buying is accelerated and is combined with a healthy demand for wiring supplies. In that section buying by distributors is confined chiefly to maintaining a flow of material for immediate uses as inventories among jobbers are being kept low. Buying in New York's holiday market shows great increases, and reports from the retail trade claim that sales are more diversified than ever before. Several large pole orders in the Eastern territory are reported.

Although the decrease in motor business which started in October is continuing, the total volume of sales during the last quarter of the year is considerably above that of 1922, according to several motor manufacturers in different parts of the country. Manufacturers are not viewing the decline with much alarm, since they realize that the exceptionally good sales rate during the Spring and Summer months could not keep up indefinitely. This condition not only delayed deliveries but imposed serious problems of production and financing upon manufacturers, some of whom possibly had not calculated the requirements for such a rush of business. The present let-up has allowed them to catch their breath and improve their shipments. However, the present volume of business is of such wide diversity that manufacturers are reporting increases in sales during the last quarter of 1923, ranging between 50 and 75 per cent higher than during the same period in 1922.



The outlook for 1924 among manufacturers is that a closer holding together of prices will characterize the market. During 1923 most manufacturers ironed out their prices to a fairly constant competitive basis. One company felt that it might expect 25 per cent greater business during 1923 if Secretary Mellon's tax reduction was accepted, and if conditions in the industrial field did not again become chaotic.

Electric Railways Expenditures

It would appear that the prediction made early in the current year that electric railways would spend $240,000,000 during 1923 in new plant and equipment will be more than realized. The application of the money has been fairly evenly divided on the basis of the needs of the various departments, but the bulk of the money has, of course, gone into track and track work. In this connection manufacturers report a demand exceedingly heavy for track material and supplies including tools used in work of this kind. One manufacturer of welding apparatus reports material sold to him from 5,500 to 6,000 joints by one company. In fact more miles of track are known to have been reconstructed during 1923 than in any previous year in the history of the industry. Orders for cars have also been unusually heavy both for replacements and in the form of additional equipment. This, of course, means in time added shop facilities, with the necessary quota of new tools.

At the inception of the increase in fares throughout the country, the tendency was toward decreased riding, but statistics show that traffic is fast returning with the result that increased earnings are available to be ploughed back into the railway properties in the form of improvements.

Industrial Expansion

Always interesting are the building statistics and predictions. *Engineering News-Record* has estimated that during the past year there has been a total building expenditure of $6,000,000,000 as compared with an expenditure in 1922 of $4,500,000,000. This publication predicts total expenditures of five billion dollars for the coming year provided that the cost of construction goes no higher. If there is a drop of as little as five per cent in costs another year equal to 1923 may be expected.

Industrial expansion during the past year caused expenditures of $500,000,000 as compared with $400,000,000 during 1922, and indications are at the present that the program for the coming year will be about equal to that of 1922. This is also on the same proviso that there is no drop in the present high costs of construction. Lower costs will mean more expansion and hence better business for the machine tool builders.

Industrial building during the year and a comparison with an average for the past three years will be found in the chart on this page.

German Textile Machinery Exports Decline

Exports of textile machinery from Germany during the past year have decreased to such an extent that during July, 1923, they amounted to only approximately 17 per cent of such shipments during the corresponding period in 1922, according to a report dated Oct. 26, from Consul M. K. Moorhead, of Stuttgart. The greatest recession was noted in finishing machines, looms, and knitting machinery.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

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FOR SOME reason the markets lack the titillation that we associate with the Chritmas season. They are resilient but not buoyant and, while business is generally described as satisfactory, there is an absence of the stimulating excitement that is usually felt when "times are good" in the United States.

An explanation of the near lethargy that prevails is difficult. Perhaps it is due to the preachments of those who believe in what they call "the business cycle." They have been so repetitious in asserting that we could avert contraction by avoiding expansion that they may have chilled enterprise and initiative.

But it must be admitted that some clouds are now visible that were not to be seen a week ago. One is the decline in the French franc, which sold at 5.12½ last Thursday. This is the lowest price of all time. It reflects a belated recognition of the magnitude of the French debt, which has been increased by 203 billion francs since the armistice and now exceeds 430 billion francs. To this must be added the paper money in circulation, amounting to 37 billion francs. At its par in gold the total of 467 billion francs is the equivalent of over 90 billion dollars.

The estimated national wealth of France at the outbreak of the war, as given in the U. S. Statistical Abstract, was but $58,398,000,000, and there are few who believe that the French can ever pay their present debt in gold unless they collect a large part of it from Germany. It is therefore natural that the value of French obligations should decline as the hope of any recovery from Germany fades.

As a further reduction in the purchasing power of Europe would probably follow if the franc became as worthless as the mark, there are some who now predict an early lessening in the export demand for our surplus production. This prediction seems logical and caution is justifiable, but our trade with France is not large and its loss would not seriously affect us if the rest of the world continued to buy here.

The predicament of the British Government is also causing some uneasiness among those who are looking abroad for trouble. The Baldwin ministry is politically impotent and there is a probability that the labor party will come into power. This contingency alarms those who fear what is called radicalism and overlook the historical fact that responsibility generally makes men conservative.

And finally there is the deadlock in our own Congress at Washington. The success of what is called the anti-railroad group in opposing Senator Cummins' election as chairman of the Interstate Commerce Commission is construed as inimical to the roads, and the reluctance of the House to consider any measure of tax reduction unless the soldiers' bonus is also provided for, dispirits those who have become persuaded that lower taxes would be a panacea for all our ills.

There is no doubt that lower taxes are desirable, but Secretary Mellon's proposal contemplates a reduction of hardly more than $3.00 per capita. If we don't get it we can probably struggle along under the present schedule for some time yet without serious distress.

> "The steel industry, the automobile industry, the electrical manufacturers and the fabricators of copper and brass are all busier than usual at this time of the year. The holiday trade is enormous. The jobbing business is good, and even the oil companies are more cheerful now that they seem to have production under control. The list of corporations declaring extra dividends is a long one. Railroad earnings are holding up wonderfully well."

But none of the troubles thus borrowed from the future has as yet been delivered. When they arrive they may prove to be less serious than they seem, for that is often the way with troubles. Meantime there can be no doubt about the present prosperity of the 111 million people who compose the population of the United States or the 10 millions who are our neighbors in Canada. Nearly everyone who is willing to work is employed and, while there are some inequalities between consumption and production, they are being gradually adjusted.

One such adjustment is being made by a reduction in our Winter wheat acreage. The Department of Agriculture says that the area planted will be 5,759,000 acres, or 12.6 per cent less than last year. If this estimate is correct the farmers may get more for their wheat despite the present bearishness of the grain trade.

In cotton a converse adjustment will have to be made if the world's needs are to be supplied, and there are some who predict that next year's cotton acreage will be the largest on record. This possibility has led to more or less speculative liquidation in the cotton market and it remains to be seen whether the mill demand will be sufficiently persistent to hold prices at the present level or advance them further. But despite the threatened curtailment of which there is now some evidence, there is little doubt that all the cotton that can be had will be wanted. There is, however, a question as to whether it will be bought intermittently or precipitately.

The steel industry, the automobile industry, the electrical manufacturers and the fabricators of copper and brass are all busier than usual at this time of the year. The holiday trade is enormous. The jobbing business is good, and even the oil companies are more cheerful now that they seem to have production under control.

The list of corporations declaring extra dividends is a long one. Railroad earnings are holding up wonderfully and if the stock market reflected the past and present instead of trying to discount the future it would probably be higher than it is. Those who believe that it is barometric insist that its apathy portends a slackening of business activity in the near future, but this assumption implies that those who trade on the Stock Exchange are more clairvoyant than the other business men of the country. This may have been the case in the past but times have changed.

The weekly statement of the Federal Reserve Banks shows a reserve ratio of 75.7 per cent as compared with 75.3 per cent a week ago. Gold holdings are smaller by $24,000,000.

Gold imports for the week are known to have been large and the reduction in the amount held by the Federal Reserve Banks reflects the efforts that are being made to camouflage the superabundance of our gold supply by putting it into circulation. The wisdom of this policy is doubtful for the time may come when the banks will want the gold back and be unable to get it. Meanwhile 90 day money can be borrowed at 3⅜ per cent in London, while it costs at least 5 per cent in New York, and Great Britain is getting much of the world's financing that would be done here if our interest rates permitted.

Pierce-Arrow Improves Its Finances

The Pierce-Arrow Motor Car Co. has announced that its bank loans have been reduced by one million dollars since the re-organization of the company under direction of Myron E. Forbes, about a year ago. Outstanding bank loans of the company are now $2,500,000. After making the payment of $1,000,000, the company had a cash balance of $1,822,333.

The Sudden "Prosperity" of France

With currency inflation exports increase and work is speeded up—No danger expected for some time to come from this condition—France as a machine tool market

BY A PARIS CORRESPONDENT

THE SLOW but steady depreciation of the French franc over the past year on the exchanges of New York, London, Geneva, Amsterdam, etc., is beginning to be noticeable in the quickening of French industries and in the rapidly growing demand from abroad for French products.

The dollar which a year ago stood at approximately 12 francs has for some time past risen until it is now quoted at 18 to 19 francs, while the pound sterling has similarly risen during the past twelve months from 42 to 80 francs. While during this interval the cost of living and the cost of labor have also increased, the increase has been proportionately small. The tendency has therefore been strong to create a favorable market for French manufactured goods in those countries whose currency has maintained its par in the face of the falling value of the franc.

With the pound sterling at 80 francs, instead of the pre-war rate of 25 francs, the French are beginning to find in England a particularly favorable market, not alone for motor cars and articles of luxury in which France has always specialized, but in necessities as well. A correspondent writing to the *London Times* recently called attention to the fact that the textile mills of northern France would during the next three months send to England piece goods valued at £1,200,000 or, at present exchange rates, 96,000,000 francs. This is only one of the points that go to make clear the present agitation in England in favor of a protective tariff and the growing fear of France as a formidable trade rival of British industries. For, if France can successfully send piece goods to England, French mills can likewise compete with British mills in the world markets that were formerly controlled by Bradford.

French Steel Situation

Another evidence of British uneasiness over the budding prosperity of French industries was given in a recent number of the *London Times* by a correspondent who stated that "with abundance of raw materials, the largest blast furnaces and the most modern steel mills in Europe, the French iron and steel trusts can flood every market in the world; not only with manufactured steel, but also with machinery of all kinds. The French can drive British steel and metallurgical products out of every neutral market and swamp our home markets."

That these statements are not exaggerated is proved by the fact that American manufacturing establishments that have built and developed branch factories in France now report that on the basis of the present exchange value of the franc they can produce more cheaply in their French factories than in America, England or in any other country where they operate plants. One large concern is now supplying the South American market from its French factory, this trade having in the past been handled by its English factory. The head of another American factory located in France recently stated that the French factory can now produce in France its full line of products with the cost of manufacture greatly below that prevailing in the home factory and that, in consequence, the policy of the company will hereafter favor a rapid and extensive development of the French plant.

Economic Conditions

In the light of this situation, it may seriously be questioned whether the depreciation of the franc that has taken place since last year has really been so bad for France as foreign politicians and economists would have the world believe. The depreciation has largely been coincident with the occupation of the Ruhr and with the internal troubles of Germany and has therefore been regarded by many as having its roots in purely political soil. Whatever the real cause may be, there is no doubt of its direct beneficial effect on the industrial situation in France and if a sudden substantial improvement should not take place in the exchange value of French currency there is a strong likelihood that the French workingman will continue to have a full dinner pail for a long time to come and that this same dinner pail will be the cause of not a small amount of envy and anxiety in some of the other European countries.

The demand for machine tools continues active and the process of utilization of surplus machines left over from the war is becoming more rapid. A number of factories have large programs for the purchase of machinery that will be realized during the next three or four months and already efforts are being made in England, where unemployment is still a serious factor, to purchase good second-hand machinery. It is reported that the Renault Automobile Works, of Billancourt, near Paris, has placed an order with a local lathe maker for one hundred 16-in. engine lathes and is building in its own shops fifty grinding machines. It is also reported that André Citroën, the maker of the Citroën car, has added to his equipment 65 Potter & Johnston automatics. There is also a rumor abroad to the effect that Citroën will install an assembly plant in England for the purpose of assembling cars from parts brought from France and for making the bodies. Citroën cars are finding favor among the British motoring public, their attractive lines and low gasoline consumption appealing to modest purses. In France it is thought likely that an effort will be made in England to double the present import duties on motor cars and thus to interfere with the present important shipments of French cars to that country.

Paris is now commemorating the fiftieth anniversary of the French Society of Physics by a fine exposition of wireless and physics in the Grand Salon on the Avenue des Champs Elysées where the automobile show is annually held. This exposition takes the place this year of the aviation exhibition.

This exposition, the first of its kind to be held in France, was made possible by the generosity of 82 exhibitors who combined to assure the promoters a guarantee fund of one million francs. The patrons, in addition to M. Millerand, President of the Republic, and M. Poincaré, Prime Minister, comprise all the Ministers, as well as many of the foremost engineers and scientists of France.

The categories of exhibits include: experimental physics, wireless telegraphy and telephony, vacuum tubes, telegraphy, telephony, signalling, various applications of electricity, electro - chemistry, electric cables, porcelain, glass, insulators, optics, photography, cinematography, lighting, heat, metallurgy, acoustics, measuring instruments, etc. Among the exhibitors, who are numerous, one of the most important is the Western Electric Co., which through its French subsidiary, Le Matériel Téléphonique, has an exceptionally fine display of wireless receiving and sending sets, automatic telephone installations, measuring instruments, etc. This company is introducing into France its new automatic telephone exchange system and other products and is meeting with such marked success that its existing factory in Paris is to be greatly extended to care for the rapidly growing demand for its specialties.

In general, it is to be regretted that there are not other American exhibits aside from that of the Western Electric Co. and it is to be hoped that when this exposition is repeated, as it no doubt will be in coming years, representative American firms will be found among the exhibitors, for France is a market that cannot long be disregarded by progressive American companies.

Ford Completing Plant at Copenhagen

By next spring the Ford Motor Co. will have completed an immense new factory at Copenhagen, Denmark, which will be one of the finest in Europe, introducing in that part of the world new standards in design and operation.

The growth of the Copenhagen assembly plant, since its opening in June, 1919, has been remarkable, and it is now the second largest factory among the foreign companies, first place being held by the plant at Manchester.

A total of 13 countries are served by Copenhagen. These include Denmark, Iceland, Faroe Islands, Sweden, Norway, Finland, Free State of Dansig, Esthonia, Latvia, Lithuania, Poland, Ukrane, and Germany.

What the Future Holds for England

Improvement in the automobile and motorcycle business with hopes for the railroad and shipbuilding industries—Many exhibitions to be staged next year

BY OUR LONDON CORRESPONDENT

OF LATE, signs have been more promising and, apart from the upsetting influence of a general election, the effect of which it is too early to estimate, it is thought that the improvement is likely to continue. Despite a rising tendency, the official cost-of-living figures remain stationary and the registered unemployed are still somewhat below the 1¼ million mark. The latest available returns of overseas' trading, indicate marked advances, those for October being on a decidedly higher level, as regards both imports and exports, than for the average of the past six months. In fact the imports were of greater value than for any month since the beginning of 1921 and, leaving out last May, this can also be claimed for the exports. It is almost the same when the figures of re-exports, that is exports of foreign and colonial merchandise, are compared, these having been beaten in the same period only by the figures of last April and May.

Reference has been made in these columns to the improvement in the motor vehicle trade, where the export side is steadily expanding. Imports of passenger cars recently made a sudden upward move. Next year's trading in motor cycles and in bicycles is thought likely to be as favorable as in the year which is now closing, and manufacturers are working to a corresponding program. Machine tool men keep in mind the fact that the motor industry, with some exceptions, shows a maintained improvement, at least as regards the lighter passenger vehicles, where prices have been again reduced, and it is hoped that the commercial vehicle section, which from several causes has been greatly depressed, will at last emerge from its troubles. Private firms that manufacture locomotives are still badly in need of work, but the railways have again commenced to ask for quotations, and the shops directly connected with the lines have a full program. Many orders, too, have been given out for wagons, coaches, etc.

SHIPYARD EMPLOYMENT

The condition of the shipbuilding industry has long been unsatisfactory. In some part at least this has been due to a trade dispute on terms of employment which has involved a lockout of some 10,000 men who, being unployed demand a higher standard of 50,000 other men. After many negotiations, the dispute has been settled and in the interval of seven months a fair number of orders have accumulated, insuring that many of the men—not all—will soon return to profitable employment. But in any case the industry is suffering from lack of orders. A change is coming over marine engineering practice and the newer engines employed demand a higher standard of machining than has been usual. Here then, it is pointed out, sooner or later will be a market for the machine tool industry.

As regards the latter there is no material change, though it must be said that machine tool firms as a whole are no worse off for work than they have been for a considerable period. In some quarters, in fact, an improvement can be claimed and stocks that have accumulated have been sold off. There is still the handicap of the second-hand machine tool. From manufacturing firms that are closing down and going out of business a steady flow of sales arises, with which the manufacturer and the ordinary merchant have to compete quite often without success. Once again the Machine Tool Trades Association has waited on the parliamentary heads of the Board of Trade to urge protection from German competition, and the assertion is being generally made that German tools have been rushed into the country by reason of the exchange position. The Safeguarding of Industries Act, as regards Part II at least, lapses next Summer, and the continued applications of the association named have been regularly unsuccessful. It is quite probable, in fact, that they have acted in a manner that accentuates the trouble. Learning that the association is going to press for protection, merchants consider the time advisable for buying, even if, as is probably the case, the tools have to be put away until the market improves. Many complaints have been made for a long period regarding German competition, and it is not to be denied that German tools have been brought into Great Britain. But they are not being put to use, at least as regards the large proportion. They remain in stores, and only in a few instances has the writer been able to find that German tools of any size have been acquired by engineering firms for immediate installation in the shops.

> "Reference has been made to the improvement in the motor vehicle trade, where the export side is steadily expanding. Imports of passenger cars recently made a sudden upward move. Next year's trading in motor cycles and bicycles is thought likely to be as favorable as in the year that is now closing, and manufacturers are working to a corresponding program."

The machine tool industry will of course hold its exhibition next year, and members of the association have applied for some 70 per cent of the floor space available. Next year, in fact, the engineer is likely in certain respects to suffer from a surfeit of exhibitions. The British Industries Fair, to be held in Birmingham in May, will of course include engineering exhibits. Then the engineering trades will make a big display for six months at Wembley, just outside London, in connection with the British Empire Exhibition. This is costing more than ten million pounds to produce. In each of these cases it may be anticipated that a few machine tools will be shown, but not a large number, the association named debarring its members from participation, in favor of its own exhibition to be held at the end of September.

Indiana Foundrymen's Conference

The Engineering Extension Service of Purdue University announces the second annual conference of Indiana foundrymen which is to be held at Purdue University on Jan. 17 and 18. This conference will be of interest to manufacturers using foundry products as well as foundrymen. No effort is being spared to secure men of national reputation along foundry lines to lead in the discussion of foundry problems and a very interesting program is assured.

A similar meeting held last year resulted in the formation of the Indiana Foundrymens' Association and the first annual meeting of this association will be held in connection with this conference.

Announce Conference on Fuel Economy

A conference has been arranged at the Engineers' Club of Philadelphia, 1317 Spruce St., for Jan. 15 at which time the subject, "Economy in the Use of Fuel," will be discussed. Three sessions have been arranged for the day. The treatment of the subject is to be confined strictly to economy, avoiding the commercial phase of competitive fuel-saving devices. The electrification of railroads, fuel-saving ideas for public utilities, and the economy of domestic fuel will be the general topics taken up. There will be several papers presented by engineers who have specialized in this subject.

Ford Plant Reported for Buffalo

It is reported unofficially at Buffalo, N. Y., that final arrangements are being made for the acquisition by the Ford Motor Car Co. of land along the River Road as the site for a new Buffalo assembling plant to cost $5,000,000. The new building would turn out 1,000 cars a day and employ 2,000 men.

The site of this plant gives dockage facilities on the Niagara river and when completed Mr. Ford would use a fleet of boats to bring materials to Buffalo from Detroit, thus practically eliminating railway transportation.

Personals

D. DEVRIES, a director of R. S. Stokvis & Zonen, Rotterdam, Holland, with an American office at 17 Battery Place, has returned to Europe after a month's business trip in the United States.

JOHN CETRULE of the Triplex Machine Tool Co., 50 Church St., New York City, has been appointed sales manager for the New York district for the Oesterlein Machine Co., Cincinnati, Ohio.

F. S. WHITMAN, president of the Belvidere Screw Machine Co., Belvidere, Ill., has resigned due to ill health.

CARL A. JOHNSON, president of the Gisholt Machine Co., Madison, Wis., has been re-elected for the second time president of the Wisconsin Manufacturers' Association.

HUGH MCLEOD of the Porter Machine Co. plant in Hatfield, Mass., has acquired the buildings and waterpower rights of the old Shattuck gun factory near there and proposes to use it for the manufacture of some of the agricultural tools formerly made by the Belcher & Taylor Co. at Chicopee Falls, patents and patterns for which were bought recently when the last-named plant was dismantled.

OSCAR H. FOGG has resigned as secretary-manager of the American Gas Association. He will become president and general manager of the Baltimore Gas Appliance & Manufacturing Co., Baltimore, Md.

LEDIE I. LAUGHLIN, a director of the Jones & Laughlin Steel Corp., of Pittsburgh, has been appointed district sales manager of the corporation at Buffalo to succeed C. S. BRADLEY, who was recently made manager of hot rolled sales at Pittsburgh.

Business Items

The Davis Machine Tool Co., Rochester, N. Y., announces that it has disposed of its business relating to keyseating machines to the Davis Keyseater Co., Rochester, N. Y.

The Calorizing Co., Pittsburgh, Pa., has acquired the exclusive sales rights for Hybnickel, the heat treating alloy perfected by Victor Hybinette. The product will henceforth be known as Calite and Mr. Hybinette will be associated with the company in a consulting capacity.

The Whyte Motor Products Co., manufacturer of the Whyte motor-control, which is moving to Muskegon Heights, Mich., from Chicago, expects to begin production by Jan. 1, according to John Whyte, company manager. The machinery has been transferred from Chicago and is now being installed in Muskegon Heights in the building formerly occupied by the Michigan Washing Machine Co.

The L. S. Starrett Co., Athol, Mass., announces a bonus, payable soon after Jan. 1, in additional wages or salary amounting to from 4 to 10 per cent of the amount paid an employee during six months ending Dec. 31, the percentage being determined by the individual's length of service.

The Motor Wheel Corp., of Lansing, Mich., is erecting a $70,000 addition to its gear plant, so the old factory may be used for production only, to meet the increasing demands for its pressed steel wheels.

The Reo Motor Car Co. of Lansing, Mich., has purchased the plant of the Duplex Truck Co. for the consideration of $200,000, it was announced this week by officials of the concern. The property of the truck company will be taken over by the Reo company Jan. 1, 1923.

The new Jewett plant, Detroit, has been completed and turned over to the Paige-Detroit Motor Car Co. by the contractors. The plant is the last word in automobile factories, according to both the architect and the construction engineer.

The Atchison, Topeka & Santa Fe Ry. is reported to have completed plans for enlargements of its shops at Emporia, Kan. A power house, machine shops and other structures will be added.

The Pennsylvania Railway is planning the construction of a one-story car shop at Camden, N. J., to replace a portion of the plant destroyed by fire some time ago.

The Illinois Central R.R. has prepared preliminary plans for the construction of new locomotive shops, engine house and oil station at Sioux City, Iowa.

The Standard Structural Steel Co., 239 Homestead Ave., Hartford, Conn., has moved into quarters at 1014 Weathersfield Ave. It has taken over the factory constructed for the Hartford Iron Works, a modern brick and steel factory, where the company will have increased facilities.

The Plimpton Lift Truck Corp. has been formed at Stamford, Conn., to manufacture industrial and factory trucks. Capital in the enterprise amounts to $100,000. The incorporators are: Bernard E. Scriven and William J. Young.

Work is to be started at an early date on the new plant for the Pressed Metal Co., Campbell St., Providence, R. I. This new industry, recently formed and incorporated by Darius Goff, Frank J. Powers, and D. W. Flint, Cranston, R. I., will manufacture auto parts. It is stated the new plant will cost $100,000 to build, and $400,000 to equip.

Obituary

S. W. JENCKES, president of the Engineering and Machine Works, St. Catherines, Ontario, Can., died recently at St. Petersburg, Florida, where he had gone to spend the Winter. He was for many years president and general manager of the Jenckes Machine Co., Sherbrooke, Quebec.

FRANCIS E. MYERS, head of the F. E. Myers & Brother Co., pump manufacturer, of Ashland, Ohio, died suddenly in that city.

Catalogs Wanted

Marki es Barta, Temesvar, Roumania, request that makers of the following classes of machines send their catalogs to them at the address given above.

(1) Machines for bending or forming chain links, preparatory to welding. The wire to be made into links is from No. 12 to No. 000 Brown & Sharpe Gage (2.2 to 10.2 millimeters).

(2) Wire-drawing machines with two drums for the sizes of wire given above.

(3) Electric welding machines for chains.

(4) Motor plows up to 20 horsepower.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

Mining machinery, tools and implements. Algiers, Algeria. Purchase. Reference No. 8548.

Road-making machines for concrete roads. Copenhagen, Denmark. Purchase and agency. Reference No. 8534.

Woodworking machines, strap saws, and planing and shaping machines. Revel, Esthonia. Agency. Reference No. 8568.

Tools, pneumatic, special tools and machines, and cement-ware machinery. Christiania, Norway. Purchase and agency. Reference No. 8552.

Forthcoming Meetings

American Engineering Council. Annual Meeting. Shoreham Hotel, Washington, D. C., Jan. 8 to 11. L. W. Wallace, Executive Secretary, 24 Jackson Place, Washington, D. C.

American Society for Steel Treating. Winter sectional meeting. Hotel Seneca, Rochester, N. Y., Jan. 31 and Feb. 1. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

Society of Automotive Engineers. Annual meeting, Jan. 22 to 25, at the General Motors Building, Detroit, Mich. Coker F. Clarkson, 29 W. 39th St., secretary.

American Gear Manufacturers Association. Spring Meeting. April 28, 29 and 30, 1924. Lafayette Hotel, Buffalo, N. Y.

Society of Industrial Engineers. Eleventh annual convention. Buffalo, N. Y. April 30, May 1 and 2. Headquarters, 608 S. Dearborn St., Chicago, George C. Dent, executive secretary.

Southern Supply & Machinery Dealers Association, National Supply & Machinery Dealers Association, and American Supply & Machinery Manufacturers Association. Triple convention, May 19, 20 and 21, 1924, Hotel Cleveland, Cleveland, Ohio. F. D. Mitchell, secretary-treasurer, 1819 Broadway, New York City.

Foreign Trade Council. Eleventh annual convention at Boston, June 4, 5 and 6. O. K. Davis, India House, Hanover Square, New York City, secretary.

The General Committee of Dividion V, Mechanical of the American Railway Association. Convention and exhibits. Atlantic City, June 11-18, 1924. V. R. Hawthorne, secretary, 431 S. Dearborn St., Chicago, Ill.

Railway Supply Manufacturers Association. Exhibit. Atlantic City, June 11-18, 1924.

The Lyons Fair. Lyons, France. March 3 to 17, 1924. Information furnished by Emile Garden, 50 Church St., New York City.

New and Enlarged Shops

Machine Tools Wanted

Ill., Chicago — Chicago, Indianapolis & Louisville R.R., 608 South Dearborn St., J. H. Liebenthal, Purch. Agt.—18 in. x 10 ft. lathe.

Kan., Pittsburg—De Sappe Motor Co., 218 South Bway., A. DeSappe, Purch. Agt.—keyseater and milling machine for motor repairs.

Mass., Charlestown (Boston P. O.)—E. A. Gillett & Sons, 286 Rutherford Ave. (manufacturer of carriages)—equipment for addition to machine and woodworking shop.

Mich., Detroit—Dept. Purchases & Supplies, 700 Marquette Bldg., G. J. Finn, Comr. —one turret lathe for street railway shop.

Mo., Carthage—J. Smith, 5th and Main Sts.—post drill and small lathe for general repairs.

Mo., Joplin—Williams Garage, 2nd and Wall Sts., E. L. Williams, Purch. Agt.—electric drill.

Mo., Kansas City—C. Foster, 3215 Chestnut Ave.—bench lathe for machine shop.

N. Y., Brooklyn—Albert Pipe Supply Co., Berry and North 13th Sts.—pipe threading machine and 3-phase motor connection friction saw.

N. Y., Buffalo—J. Flander, 233 South Division St.—heavy stamping press.

N. Y., Buffalo—E. Hammond, 221 Forrest Ave.—equipment for garage repair shop.

O., Columbus—A. E. Lind, 22 East Walnut St.—24 in. lathe, drill press, etc., for garage and repair shop.

O., Toledo—West Toledo Plumbing & Heating Co., Central St. and Upton Ave., B. C. O'Connell, Purch. Agt.—shop equipment and tools.

Pa., Wilkes-Barre—A. W. Grebe, Carey Ave.—tools and equipment for proposed garage.

Tex., Eastland—J. Simmons, Box 42 (machine shop)—pipe threading machine up to 15/8 in. pipe.

Tex., Houston—The Shop, Box 1495—portable forge and electric drill press.

Tex., San Angelo—The Machine Shop, 609 South Oak St.—drill press and threading machine, up to and including 6 in. pipe.

Tex., Tyler—St. Louis Southwestern Ry. Co., F. C. Warren, Genl. Store Keeper—shop tools and plant machinery for the repair of motive power equipment.

Wis., Fort Atkinson—R. D. Royce—machine shop equipment, including drill press and lathe.

Wis., Milwaukee — Milwaukee Paint & Varnish Wks., 1523 Holton St.—medium size electric drilling machine.

Wis., Milwaukee — F. Schneeberg, 946 38th St.—lathe, drill press and emery grinder for automobile repairs.

Que., Montreal—J. B. Ballargeon, 415 St. Denis St.—complete equipment, including gasoline tank and pump for garage.

Que., Montreal—H. Burke, 104 Carriere St.—drill press for garage.

Que., Montreal—A. Cardinal, 540 Amherst St.—tools, emery wheel and other equipment for automobile repair shop.

Que., Montreal—E. G. Horne, 813 New Birks Bldg.—complete equipment for garage and automobile repair shop.

Que., Montreal—I. Kennedy, 501 Seigneurs St.—tools, vise, press, etc., for garage.

Que., Montreal—E. Martel, 506 Harbour St.—drill press and chain hoist for garage.

Que., Montreal—J. O'Brien, 107 Garnier St.—machinery and equipment for automobile repair shop.

Que., Montreal—Y. Rioux, 13 Grant St.—hand tools and drill press for garage.

Que., Montreal—I. H. Seguin, 588 Dorchester St.—tools and equipment for garage.

Que., Montreal—C. Sicotte, 415 Ontario St., E.—air compressor, lathe, etc., for garage.

Que., Rimouski—J. A. Brillant—automobile repair tools.

Que., St. Flavien—T. Daigle—equipment for garage and repair shop.

Que., St. Romuald d'Etchemin—G. Robitaille, 33 Fabrique St.—lathe for garage.

Que., Westmount—G. Deacey, 27 Hillside Ave.—press, files and hand tools for automobile repair shop.

Machinery Wanted

Calif., San Francisco—Natl. Paper Products Co., 1789 Montgomery St., and Zellerbach Paper Co., 534 Battery St.—equipment for proposed plant at Los Angeles.

Ill., Elgin—C. J. Moody, 159 Grove St. (cabinet maker)—6 to 8 x 30 in. planer.

Ind., Hammond—F. Kraus & Son, 488 Holman St.—complete woodworking machinery.

Ky., Fleming—Neon Ice & Ice Cream Co. —refrigerating equipment for 10 ton ice plant.

Me., Biddeford—Diamond Match Co.—machinery for addition to plant for the manufacture of sash, doors, mouldings, etc.

Mass., Allston (Boston, P. O.)—Griffith, Keiver & Co., 124 Western Ave.—machinery, including large and medium size band and circular saws, planer, matcher, sander, belting, pulleys, shafting, etc., for proposed woodworking shop.

Mass., Boston—Union Spinning & Plating Co., 67 Sudbury St.—air compressor, tank, pump, air hose, 25 hp. motor and lacquer spraying nozzle (used).

Mass., Cambridge—Viscol Co., 200 1st St.—Universal printing press, 14 x 22 in., Gally or Colt preferred (used).

Mass., East Boston (Boston P. O.)—Boston Sand & Gravel Co., 33 Condor St.—crane and coal hoist, steam operated preferred, also belt conveyor.

Mass., Roxbury (Boston, P. O.)—F. G. Whitaker, 180 Harrison Ave.—light woodworking machinery and small tools for shop.

Mich., Iron Mountain—Model Bakery, A. Rocheleau, Purch. Agt. — motor driven mixers, sifters, etc., also mechanical oven.

Mo., St. Louis — Brock Motor Car Co., 4418 Olive St.—air compressor, medium size, for garage.

Mo., St. Louis—J. Seidel Lumber Co., 2200 South Kingshighway—welding outfit.

Mo., St. Louis—The Tinshop, 6406 Grand Ave.—42 in. shears and tinner's brake.

N. Y., Ballston Spa—Ballston Knit Glove Co., Inc., W. Bellefeld, Mgr.—knitting machines for cotton gloves for addition to factory.

N. Y., Binghampton—W. H. Yager Co., Water and Henry Sts.—equipment for proposed warehouse.

N. Y., Buffalo—P. Simini, 53 Peach St.—equipment for bakery.

N. Y., Ellicottville—Fitzpatrick & Weller —machinery for novelty factory, to replace that which was destroyed by fire.

N. Y., Granville—H. G. Williams Slate Co.—one roll crusher for reducing slate from primary jaw crushers to granules size for screens.

O., Akron—Bd. of County Comrs., S. Porter, Clk., Court House—receiving bids until Jan. 2 for refrigerating plant in Children's Bldg., at the Springfield Lake Sanitorium.

O., Columbus—Dept. of Finance, J. P. Brennan, Supt. of Purchase, Room 75 State House—receiving bids until Jan. 11 for laundry equipment for state hospitals, here, at Massillon and at Athens; Longview Hospital, Cincinnati; also for Institution for Feeble Minded at Orient.

O., Martins Ferry—W. Hell, 1st St.—packing plant, cold storage and refrigeration equipment.

Okla., Tulsa—Clipson Cleaning & Dying Co., 915 South Main St., P. C. Clipson, Purch. Agt. — equipment for proposed laundry.

Pa., Greensburg—Railway & Industrial Eng. Co.—5 ton, 30 ft. span, overhead crane.

Pa., New Castle—Blair Strip Steel Co.—cranes for proposed plant.

Pa., Pittsburgh—A. M. Byers Co., 235 Water St. (pipe), A. Stauffer, Purch. Agt. —one locomotive crane for Girard, O.

Pa., Pittston—Pittston Press, 25-29 Market St. (newspaper), W. Hughes, Purch. Agt.—complete equipment and presses to replace fire loss.

Tex., Denton—W. M. Jagol Co.—15 x 24 in. jaw rock crusher.

Tex., Harlingen—Rangerville Gin Co.—machinery for cotton gin, capacity 50 bales per day.

Tex., Houston—Battery Shop, R. R. 2, Box 43C, D. A. Parsons, Proprietor—battery rectifier and complete charging outfit.

Wis., Manitowoc — Grimm Aluminum Casting Co., foot of 21st St.—casting machines.

Wis., Manitowoc — A. Schroeder, c/o Courthouse—heavy duty rock crushing machinery.

Wis., Milwaukee—H. Landauer, 137 8th St.—chain hoist and electric drill for garage.

Wis., Milwaukee—I. C. Lyman, 93 Michigan St.—conveying machinery for proposed $100,000 grain elevator.

Wis., Milwaukee — Manegold Mfg. Co., 3015 Highland Blvd., W. H. Manegold, Purch. Agt. — equipment, including woodworking machinery, for the manufacture of automobile body fittings.

Wis., Milwaukee — Milwaukee Woodwork Mfg. Co., 3320 Fond du Lac Ave.—additional woodworking machinery, including sander.

Wis., Portage—J. T. Henton (quarry)—rock crushing machinery, motor or gasoline engine driven.

Ont., Alexandria—C. Lacombe—bandsaw.

Ont., Maxville—H. J. Fraser—press and other equipment for repair and blacksmith shop.

Ont., Sault Ste. Marie—Dam Creek Lumber Co., Ltd., S. F. Postal, Evart, Mich., Purch. Agt.—saw and shingle mill equipment.

Ont., South River—Natl. Veneer & Lumber Co., Ltd.—woodworking equipment.

Ont., Williamsburg—P. E. Beckstead—equipment for blacksmith shop.

Que., Mont Joli—Rouleau, Ltd.—foundry machinery for expansion program.

Que., Montreal—E. Bessette, 540 Labreque St.—foundry equipment.

Que., Montreal—J. Christin & Cie., Ltd., 21 St. Julie St. (ginger ale, etc.)—bottling machinery and equipment.

Que., Montreal—Deforse & Co., 7 Hermine St.—circular saw, 4 ft. table.

Que., Montreal—L. De Jean, 492 Lagauchetiere St., W. (welding)—grinder.

Que., Montreal—Dubois & Co., Ltd., 62 St. Urbain St.—sash and door machines.

Que., Montreal—O. Foisy, 31 St. Catherine St., E.—equipment for job printing shop.

Que., Montreal—F. Goyer, 335 Davidson St.—tools and equipment for blacksmith shop.

Que., Montreal—H. Houle, 155 Vinet St. —pony job printing press (used).

Que., Montreal—J. Natovitch, 1219 St. Dominique St.—blacksmith shop equipment.

Que., Montreal—N. Poirier, 591 Marie Anne St., E. (cabinet maker)—wood lathe.

Que., Montreal—Red Star Refineries, Ltd., Canadian Cement Bldg.—machinery and equipment for oil refinery at Montreal East.

Que., Montreal—G. Rochon, 1148 Bellechane St., E.—equipment for saw and planing mill.

Que., Ste. Croix—Lotbruiere Wood Mfg. Co., J. C. Auger, owner — woodworking equipment, including molder.

Que., St. David de Levis—A. Begin—job printing press.

Que., St. Leon le Grand—D. Marin—sawmill equipment.

Que., St. Laurent—E. Gohier, 48 De l'Eglise St. (lumber)—ripsaw and bandsaw.

Que., St. Mathieu—E. Dionne—resaw, planer and bandsaw.

The Weekly Price Guide

Rise and Fall of the Market

Iron and Steel—Pig-iron market very quiet. No. 2 foundry iron quoted as low as $20@$21 per ton at Birmingham. Iron and steel scrap buying active; prices tending upward. Tin plate demand fairly good; mills operating at 96 per cent of capacity. Fabricated structural steel prices still firm at $2.50 for plates and shapes and $2.40 per 100 lb. for bars, f.o.b. Pittsburgh.

Advances—Galvanized steel sheets advanced 5c. per 100 lb. at Pittsburgh mill. Copper demand better. Lead market strong; scarcity of metal; price up ¼c. per lb. in week. Zinc market tending upward; price rose 7½c. per 100 lb. in New York warehouses. Antimony ½c. per lb. higher than week ago.

Declines—Machine oil down about 0.7c. per gal. in certain grades; advance expected in Pennsylvania grades.

IRON AND STEEL

PIG IRON—Per gross ton—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$25.05
Northern Basic	24.00
Southern Ohio No. 2	24.00
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	28.00
BIRMINGHAM	
No. 2 Foundry	22.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	24.25
Virginia No. 2	28.17
Basic	24.00
Grey Forge	24.00
CHICAGO	
No. 2 Foundry local	24.50
No. 2 Foundry, Southern (silicon 2.25@2.75)	27.00
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	25.77
Basic	25.77
Bessemer	26.77

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.75
Cleveland	4.75
Cincinnati	5.00@7.50
New York	5.00@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh	New York	Cleveland	Chicago
No. 10	2.90@3.00	4.34	3.75	4.00
No. 12	3.00@3.10	4.39	3.80	4.05
No. 14	3.10@3.20	4.44	3.85	4.10
No. 16	3.30@3.40	4.54	3.95	4.20
Black				
Nos. 17 and 21	3.70	4.30@4.55	4.45	4.70
Nos. 22 and 24	3.75	4.35@4.60	4.50	4.70
Nos. 25 and 26	3.80	4.40@4.65	4.55	4.75
No. 28	3.85	4.50@4.75	4.65	4.85
Galvanized				
Nos. 10 and 11	3.90@4.00	4.50@4.80	4.70	4.85
Nos. 12 and 14	4.00@4.10	4.60@4.90	4.80	4.95
Nos. 17 and 21	4.30@4.40	4.90@5.20	5.10	5.24
Nos. 22 and 24	4.45@4.55	5.05@5.35	5.25	5.40
No. 26	4.60@4.70	5.20@5.45	5.50	5.55
No. 28	4.90@5.00	5.50@5.75	5.80	5.85

WROUGHT PIPE (Welded)—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	48%	34%	55½%	43½%	50%	37%
2½ to 6 in. steel lap welded	44%	30%	53½%	40½%	47%	34%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4%; class A, plus 23%. Cast iron, standard sizes, 34% off.

SEAMLESS STEEL TUBING—Following base discounts are on 20 gauge or .035-in., round, cold-drawn tubing, ¼-in. to 1-in., O.D., weighing 0,17 lb. to 0.36 lb. per ft. Cutting charge per 100 cuts, $1.50 to $1.58:

O.D. Inches	List Price per ft.	Differential Discount	O.D. Inches	List Price per ft.	Differential Discount
¼	$0.09	50%	⅞	$0.16	35%
⅜	.11	45%	1	.18	31%
½	.14	40%			

NOTE—The discounts are to be lowered by the following differentials in the case of regular .10-.20 carbon: 25,000 ft. or over, 83; 15,000 to 25,000 ft., 82; 5,000 to 15,000 ft., 81; 1,000 to 5,000 ft., 80; less than 1,000 ft., 79.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.20
Spring steel (light) (base)	7.00	6.00	6.00
Coppered Bessemer rods (base)	6.53	8.00	6.70
Hoop steel	5.19	4.66	4.55
Cold rolled strip steel	7.50	8.25	8.35
Floor plates	5.80	5.66	5.80
Cold drawn shafting or screw	4.40	3.90	4.30
Cold drawn flats, squares	4.90	4.40	4.80
Structural shapes (base)	3.64	3.46	3.30
Soft steel bars (base)	3.54	3.36	3.20
Soft steel bar shapes (base)	3.54	3.36	3.20
Soft steel bands (base)	4.39	3.61	3.95
Tank plates (base)	3.64	3.46	3.30
Bar iron (3.10@3.15 at mill)	3.54	3.36	3.20
Tool steel	11.00	....	....
Drill rod (from list)	55%	40@55%	50%

Electric welding wire, New York, 3/32, 8.35c.; ⅛, 7.85c.; 5/32 to ¼, 7.35c. per lb.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			13.87½
Tin, 5-ton lots, New York			47.50
Lead (up to carlots), St. Louis	7.75	New York	8.37½
Zinc (up to carlots), St. Louis	6.20@6.25	New York	6.67½

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	25.20	27.00	28.50
Antimony (Chinese), ton spot	10.25	10.50	10.25
Copper sheets, base	21.00	21.00@21.25	23.00
Copper wire, base	16.25	19.00	16.25
Copper bars, base	20.00	22.50	19.50
Copper tubing, base	23.50	27.25	23.00
Brass sheets, base	17.75	22.00	18.75
Brass tubing, base	22.00	27.00	20.50
Brass rods, base	15.50	18.00	15.75
Brass wire, base	18.25	22.00	....
Zinc sheets (casks)	10.25	10.45	....
Solder (½ and ½), (case lots)	33.75	31.75	30.00
Babbitt metal (83% tin)	52.00	59.50	48@52
Babbitt metal (35% tin)	25.00	18.50	22@25
Nickel (ingot and shot)	29.00	....	....
Nickel (electrolytic)	32.00	....	35.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel sheet (base)	57.00
Hot rolled rods, Grade "A" (base)	55.00
Cold drawn rods, Grade "A" (base)	63.00

Shop Materials and Supplies

METALS—Continued

Copper nickel ingots	37.00
Hot rolled copper nickel rods (base)	45.00
Manganese nickel hot rolled rods "E"—low manganese (base)	57.00
Manganese nickel hot rolled rods "D"—high manganese (base)	60.00

Base price of monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	40.00
Blocks	32.00	Cold drawn rods (base)	48.00
Ingots	38.00	Hot rolled sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	11.75	11.00	11.50
Copper, heavy, and wire	10.75	10.50	10.75
Copper, light, and bottoms	9.50	8.75	9.75
Lead, heavy	5.75	5.25	6.00
Lead, tea	4.75	4.00	5.00
Brass, heavy, yellow	7.00		7.25
Brass, heavy, red	8.75	9.25	9.00
Brass, light	6.25	5.00	6.25
No. 1 yellow brass turnings	7.00	5.75	6.75
Zinc	3.75	2.75	3.75

TIN PLATES—American Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	20x28, 112 sheets	$25.10	$22.85	$18.50
"A" Grade:				
IC,	20x28, 112 sheets	21.40	18.00	17.00
	Coke Plates—Primes, 20x28 in.			
100-lb.,	112 sheets	14.00	13.00	14.50
	Terne Plates—Small lots, 8-lb. Coating			
IC,	14x20	8.25	6.55	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.11@0.14	$0.15	$0.14
Cotton waste, colored, per lb.	.09@.14	.12	.10½
Wiping cloths, 13¼x13¼, per lb	9.00	36.00 per M	.16
Wiping cloths, 13¼x20½, per lb.		52.00 per M	.16
Sal soda, per 100 lb.	2.40	2.25	2.65
Roll sulphur, per 100 lb.	3.60	3.25	3.50
Linseed oil, per gal., 5 bbl. lots	.95	1.00	.94
Lard cutting oil, 25% lard, per gal.	.55	.50	.67½
Lard oil, pure, per gal, 2 to 5 bbl. lots	.76	.73	.71
Machine lubricant, medium-bodied (50 gal. wooden bbl.), per gal.	.29	.35	.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 2c. per sq.in., per ply:			
Medium grade	30–10%	30–10%	30–10%
Heavy grade	20–5–2½	30%	20–5–2½%
Rubber and duck:			
First grade	50–10–5%	50–10%	40–10%
Second grade	60–5%	60–5%	60–5%
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$6.30	$5.84	$6.48
Emery paper	9.90	11.00	8.80
Emery cloth	31.12	31.12	29.48
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.49	1.24	1.40
Cloth	3.38	2.67	3.20
Fire clay, per 100 lb. bag		.65	.60
Coke, prompt furnace, Connellsville	per net ton		4.00@4.40
Coke, prompt foundry, Connellsville	per net ton		5.25@6.50
White lead, dry or in oil	100 lb. kegs		New York, 14.00
Red lead, dry	100 lb. kegs		New York, 14.00
Red lead, in oil	100 lb. kegs		New York, 15.50

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0354	$0.0354	$0.0304
Cold finished shafting	per lb.	0.044	0.0465	0.039
Brass rods	per lb	0.155	0.1475	0.17
Solder (½ and ½)	per lb.	0.3375	0.31	0.275
Cotton waste	per lb.	.11@.14	.10@.13	.09@.11½
Washers, cast iron (⅛ in.)	per 100 lb.	6.50	6.50	6.00
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.38	3.38	3.02
Lard cutting oil	per gal.	0.55	0.55	0.50
Machine oil	per gal.	0.29	0.297	0.33
Belting, leather, medium	off list	30–10%	30–10%	30–10%
Machine bolts up to 1x30 in.	off list	45%	40–10%	40%

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	45%	60%	50–5%
1¼ and 1¼x3 in. up to 12 in	15%	50–5%	50%
With cold punched hex. nuts up to 1 in. diam. (plus std. extra of 10%)	30%	$3.50 net	
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	35%	3.50 net	$4.00 off
Button head bolts, with hex. nuts	List net	List net	
Hex. head and hex. nut bolts	List net		65–5%
Lag screws, coach screws	45%		60–5%
Square and hex. head cap screws	60%	70%	70–10%
Carriage bolts, up to 1 in.x30 in.	35%	50%	50–5%
Bolt ends, with hot pressed nuts	45%		55%
Tap bolts, hex. head, list plus	35%		
Semi-finished nuts, 1/16 and smaller	65%		
Semi-finished nuts, ⅝ and larger	60%	70%	80%
Case-hardened nuts	50%		
Washers, cast iron, ½ in., per 100 lb. (net)	$6.50	$4.00	$4.00
Washers, cast iron, ⅝ in., per 100 lb. (net)	5.50	4.00	4.00
Washers, round plate, per 100 lb. Off list	1.50	4.00	4.00
Nuts, hot pressed, sq., per 100 lb. Off list	1.00	3.50	3.50
Nuts, hot pressed, hex., per 100 lb. Off list	1.00	3.50	3.50
Nuts, cold punched, sq., per 100 lb. Off list	1.00	3.50	3.50
Nuts, cold punched, hex., per 100 lb. Off list	1.00	3.50	3.50
Rivets:			
Rivets, 7/16 in. dia. and smaller	50%	60%	60%
Rivets, tinned	50%	60%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb. (net)	$5.00	$3.60	$3.75
Cone heads, ditto (net)	5.20	3.80	3.85
1⅛ to 2-in. long, all diameters, *EXTRA* per 100 lb.	0.25		0.15
⅜ in. diameter *EXTRA*	0.35		0.15
½ in. diameter *EXTRA*	0.75		0.50
1 in. long, and shorter *EXTRA*	0.75		0.50
Longer than 5 in. *EXTRA*	0.50		0.25
Less than 200 lb. *EXTRA*	0.50		0.50
Countersunk heads *EXTRA*	0.45		$3.70 base

Metal Working Shops

Ark., Hot Springs—M. J. Henderson, c/o Arkansas Trust Co., 621 Central St., will build a 3 story, 110 x 159 ft. garage. Estimated cost $50,000.

Calif., Alhambra — The Amer. Liquid Meter Co., 405 West Rose Rd., San Gabriel, plans to build a plant for the manufacture of measuring apparatus, here. Cost will exceed $75,000.

Calif., Corcoran — The Corcoran Union High School Dist. awarded the contract for the construction of a 1 story addition to manual training shops. Estimated cost $6,500.

Calif., Emeryville — Cozzens-Ball Inc., 48th St. and San Pablo Ave., Oakland, is having plans prepared for the construction of a 1 story garage on San Pablo Ave., here. Estimated cost $85,000. F. Soderberg, 276 Perkins St., Oakland, Archt.

Calif., Glendale (Los Angeles P. O.)—Tanner & Hall, 237 South Brand St., Buick Agents, awarded the contract for the construction of a 1 story, 75 x 156 ft. garage on Maple and Brand Sts.

Calif., Hanford — The Hanford Union High School Dist. is having plans prepared for the construction of a 1 story shops building, including automotive department, battery room, machine shops, etc. Estimated cost $30,000. Coates & Traver, Rowell Bldg., Fresno, Archts.

Calif., Hayward — Dohner & Galbraith, 1036 A St., plans to build a 1 story garage and automobile sales room. Estimated cost $40,000.

Calif., Long Beach—The Ocean View Garage, 34 Locust St., awarded the contract for the construction of a 1 story, 120 x 170 ft. garage on American Ave. and 20th St.

Calif., Los Angeles—M. A. Bresee, 941 Bon Brae St., awarded the contract for the construction of a 1 story, 60 x 150 ft. garage on Bronson Ave.

Calif., Los Angeles—R. C. Durant, 10910 East 14th St., Oakland, A. G. Waddell, 346 Hanover St., Oakland, et al., plan to build a factory for the manufacture of transmissions for Star motor cars, here. Estimated cost, including machinery, $2,500,000.

Calif., Los Angeles — The Hoyt Heater Co., 2838 East 2nd St., manufacturer of heaters, furnaces, etc., is having plans prepared for the construction of a 1 story, 70 x 200 ft. factory on Santa Fe Ave. Estimated cost $40,000. Walker & Eisen, Pacific Finance Bldg., Los Angeles, Archts.

Calif., Los Angeles—The Peerless Auto Agency, 1620 South Figueroa St., is having plans prepared for the construction of a 2 story, 114 x 150 ft. garage and salesroom on Gordon St. M. Swasey, Hibernian Bldg., Los Angeles, Archt.

Calif., Los Angeles—Retzer Bros., 1200 East 7th St., awarded the contract for the construction of a 1 story, 110 x 160 ft. garage on Pasadena Ave.

Calif., Oakland — R. McGahie & S. P. Palmer, Mills Bldg., awarded the contract for the construction of a 1 story garage on Piedmont Ave. Estimated cost $42,000.

Calif., Oakland—The Telegraph Ave. Corp., c/o M. I. Diggs, Archt., 19th St. and Telegraph Ave., has had preliminary plans prepared for the construction of a garage. Estimated cost $150,000.

Calif., Sacramento—The W. P. Fuller Co., 10th and R Sts., is having plans prepared for the construction of first unit of 2 story plant consisting of a warehouse and workshop, to replace the one which was destroyed by fire. Estimated cost $50,000. E. C. Hemmings & L. Stark, Ochsner Bldg., Sacramento, Archts.

Calif., San Francisco—The Amer. Can Co., Mills Bldg., awarded the contract for the construction of a garage and oil storage building on 20th and Illinois Sts. Estimated cost $42,000.

Calif., San Francisco—Lawson & Drucker, 450 Hayes St., are having plans prepared for the construction of a 2 story plumbing and heating shop on Tehana St. Estimated cost $40,000. Private plans.

Calif., San Francisco—J. Pasqualetti, 785 Market St., awarded the contract for the construction of a 2 story garage on Ocean Ave. Estimated cost $45,000.

Calif., San Francisco—J. Pelaprat, 202 14th St., plans to build a 1 story, 50 x 275 ft. garage on 18th St. near Sanchez St. Estimated cost $42,000.

Calif., San Francisco—A. Potter, c/o A. J. Fabre, Archt., 110 Sutter St., awarded the contract for the construction of a 2 story machine shop on Folsom St. near 9th St. Estimated cost $10,000.

Calif., Santa Monica—H. Malian, 1232 11th St., awarded the contract for the construction of a 1 story garage on Santa Monica Blvd. Cost will exceed $45,000.

Conn., Wallingford — The International Silver Co., Center St., awarded the contract for the construction of three 1 story, 45 x 125 ft. factory buildings. Estimated cost $60,000.

Conn., Waterbury—The Waterbury Rolling Mills, Inc., Watertown Ave., manufacturer of sheet brass, awarded the contract for the construction of a 1 story factory. Estimated cost $50,000.

Ill., Chicago—L. Bromberg, 1252 North Oakley St., will build a 1 story, 103 x 250 ft. automobile sales room and service station at 3250-56 Milwaukee Ave. Estimated cost $100,000. Noted Sept. 20.

Ill., Chicago—D. S. Klafter, Archt., 64 West Randolph St., is receiving bids for the construction of a 1 story, 150 x 150 ft. automobile service building and garage on Lawrence and Ridgeway Sts. for A. Natlin, c/o Architect. Estimated cost $75,000.

Ill., Chicago—The W. E. Garage Co., c/o Halperin & Braun, Archts., 19 South La Salle St., awarded the contract for the construction of a 2 story, 96 x 125 ft. garage at 1830-38 West Madison Et. Estimated cost $90,000.

Ill., Chicago — The J. J. Wright Motor Co., 353 East 55th St., awarded the contract for the construction of a 1 story, 105 x 180 ft. automobile service station and garage near Princeton and 55th Sts. Estimated cost $70,000.

Ind., Angola — The Standard Body Co. plans to build an addition to its automobile body plant. Estimated cost $200,000.

Ind., Bloomington — N. Hill is having plans prepared for the construction of a 2 story, 70 x 132 ft. garage. Estimated cost $50,000. J. L. Nichols, Bloomington, Archt.

Ind., Indianapolis — L. B. Millikin, 501 North Delaware St., awarded the contract for the construction of a 1 story, 97 x 107 ft. garage on 21st St. Estimated cost $50,000. Noted Dec. 6.

Ia., Sioux City—F. H. Clark, 609 Pierce St., awarded the contract for the construction of a 2 story, 100 x 150 ft. garage and filling station on 5th and Jennings Sts. Estimated cost $51,790.

Ky., Paducah—The Shelton Bros. Fdry. Co. plans to build a 1 story foundry for the manufacture of steam boat machinery. Estimated cost $40,000.

Mass., Charlestown (Boston P. O.)—E. A. Gillett & Sons, 286 Rutherford Ave., manufacturer of carriages, awarded the contract for the construction of a 1 story, 50 x 170 ft. machine and woodworking shop. Estimated cost $28,000. The owner also plans to build a 50 x 130 ft. addition.

Mass., Millbury—The New England High Carbon Wire Co. plans to build an addition to machine shop.

Mass., Worcester—H. Mandell, 33 Derby St., is having plans prepared for the construction of two 2 story, 60 x 125 ft. machine repair shops on Foster St. Estimated cost $60,000. H. L. Meacham 571 Main St., Archt.

Mo., St. Louis—The Warren Steel Casting Co., 3400 Maury Ave., awarded the contract for the construction of a 1 story, 60 x 200 ft. steel foundry. Estimated cost $60,000. Noted Nov. 29.

N. J., Camden—The Pennsylvania R.R., E. F. McClintock, master carpenter, Pennsylvania Offices, will receive bids until Dec. 26 for the construction of a 1 story, 86 x 150 ft. machine shop on Clinton St. Estimated cost $75,000. W. H. Cookman, Broad St. Sta., Phila., Pa., Archt.

N. J., Camden — The Standard Tank & Seat Co., 314 North Front St., manufacturer of plumbing supplies, awarded the contract for the construction of a 3 story, 44 x 54 ft. factory. Estimated cost $20,000.

N. Y., Yonkers — J. J. Hayes, Proctor Bldg., will build a 2 story, 100 x 100 ft. garage. Estimated cost $50,000.

N. C., Ashville—The Overland-Knight Co., Inc., is having plans prepared for the construction of a 4 story garage to contain 100,000 sq.ft. of floor space. Estimated cost $300,000. Smith & Carrier, Ashville, Archts.

O., Cleveland—The Curtiss-Ambler Realty Co., Arcade Bldg., is having plans prepared for the construction of a 1 story (ultimately 2 story), 60 x 160 ft. factory and garage at 2324 Prospect Ave. Estimated cost $50,000. W. E. Ambler, Pres. H. K. Ferguson Co., 4900 Euclid Ave., Archts. Auto Electrical Maintenance Co., c/o H. E. Page, Treas., 943 Chester Ave., lessee.

O., Cleveland—The P. A. Geier Co., 540 East 105th St., manufacturer of vacuum cleaners, awarded the contract for the construction of a 4 story, 80 x 240 ft. factory. Estimated cost $300,000.

O., Cleveland—A. P. Jones, 304 Alhambra Theatre Bldg., has had plans prepared for the construction of a 1 story, 70 x 70 ft. garage on East 71st St. and Cedar Ave. Estimated cost $40,000. Private plans.

O., Cleveland—G. Margolin, 2496 Derbyshire Rd., Cleveland Heights, is having plans prepared for the construction of a 2 story garage on Chester Ave., here. Estimated cost $60,000. M. Weis, 617 Union Bldg., Cleveland, Archt.

O., Cleveland—C. F. Neuberger, c/o Statler Hotel, is having plans prepared for the construction of a 1 and 4 story garage on a 60 x 90 ft. site at 1905 Prospect Ave. Estimated cost $100,000. A. F. Janowitz, 811 Prospect Ave., Cleveland, Archt.

O., Cleveland—The Peerless Motor Car Co., 2555 East 93rd St., awarded the contract for the construction of a 1 story, 96 x 196 ft. addition to its factory. Estimated cost $45,000.

O., Columbus—The Belt-Franklin Co., 224 East Gay St., plans to build a 3 story, 62 x 187 ft. garage and salesroom on East Broad St. Estimated cost $150,000. Engineer or architect not announced.

O., Uhricksville—The Federal Collieries Co., Leader-News Bldg., Cleveland, manufacturer of sewer pipe, is building a 3 story, 112 x 286 ft. factory, a 48 x 80 ft. machine shop and a 42 x 82 ft. boiler room, here. Estimated cost $250,000. H. H. Felsmans, Secy.

Pennsylvania—The Bethlehem Steel Co., Bethlehem, plans a construction program to include construction of clay mixing and ladle house for blast furnaces; installation of coke screening system for three Franklin furnaces; coal spillage elevator at Rosendale coke plant; changes and additions to steel car plant, Franklin. W. M. Tobias, Genl. Purch. Agt.

Pa., Holmesburg (Phila. P. O.) — The Electric Development & Machine Co., Shellmere and Edmunds Sts., awarded the contract for the construction of a 1 story, 84 x 432 ft. machine shop. Estimated cost $75,000.

R. I., Pawtucket—The New England Machine & Electric Co., 31 Bayley St., awarded the contract for the construction of a 1 story, 75 x 120 ft. machine shop. Estimated cost $25,000.

Tenn., Knoxville—The Day-Evans Iron Wks., Inc., plans to build a 1 story, 75 x 160 ft. foundry for the manufacture of mine cars.

Tenn., Memphis—I. Landrum is building a 1 story, 60 x 85 ft. shop at 338-342 Adams Ave. Estimated cost $12,000. Southern Mchy. & Fdry. Co., lessee.

Tex., Fort Worth—The Gabert Auto Wks., Throckmorton St., awarded the contract for the construction of a 2 story, 110 x 200 ft. garage. Estimated cost $50,000.

Tex., San Antonio—E. Friedrich, 802 East Commerce St., will build a 140 x 230 ft. factory for the manufacture of show cases, restaurant refrigerating systems, etc., on Paso Hondo St. Estimated cost $40,000.

W. Va., Williamson—The Universal Motor Corp. awarded the contract for the construction of a 1 story, 90 x 150 ft. garage. Estimated cost $40,000.

Wis., Clintonville—A. O. Haase is having plans prepared for the construction of a 2 story, 30 x 50 ft. garage and repair shop. Estimated cost $45,000. Private plans.

Wis., Lakemills — The Overland Garage Co., c/o O. W. Farmer, Mgr., awarded the contract for the construction of a 1 story, 50 x 70 ft. garage. Estimated cost $40,000.

Wis., Madison — The Madison Medical Assn., c/o R. S. Ingersoll, Lakeside St., will build a 2 story, 45 x 100 ft. garage, etc. Estimated cost $50,000. Noted Nov. 1.

Wis., Milwaukee — The Yunker-Hansen Sales Co., 6516 Greenfield Ave., awarded the contract for the construction of a 1 story, 40 x 120 ft. garage. Estimated cost $40,000.

Wis., Wausau—The Wausau Parts Mfg. Co., c/o W. A. Schoefield, Mgr., plans to build a 2 story, 60 x 90 ft. factory for the manufacture of automotive equipment. Estimated cost $50,000. Engineer or architect not selected.

N. B., St. Stephen—The Hollingsworth & Whitney Co., 185 Devonshire St., Boston, Mass., is having plans prepared for the construction of a paper and pulp plant, including machine shop, etc., on the St. Croix River, here. Estimated cost $300,000. Private plans.

Ont., Wiarton—W. McCrabb plans to rebuild garage and repair shop which was destroyed by fire. Estimated cost $40,000.

Que., Outremont — The Bernard Ave. Garage Co. is having plans prepared for the construction of a 90 x 167 ft. garage on Bernard and De L'Epee Sts. Estimated cost $250,000. Perfrault & Godbois, 2100 Park Ave., Montreal, Archts.

"WHITNEY"
KEY-SEAT CUTTERS
For the Woodruff System of Keying

BE SURE AND GET OUR PRICES

Prompt Deliveries in either Carbon or High-Speed Steel

Of course, you are interested in high production. Then use "WHITNEY" Cutters as they are made perfectly square, run absolutely true, and are accurate to size. If you use "WHITNEY" Cutters your key-seats will be cut so that keys will fit without filing or fussing.

Remember, you should use the "WHITNEY" Spring Collet for holding these cutters, thus economizing your time and guarding against injury to the cutter shanks.

"WHITNEY" KEYS

are made in sizes to correspond with "WHITNEY" Cutters and can be furnished in either High Carbon or Nickel Steel. They will fit the key-seats made with our cutters without filing or fitting.

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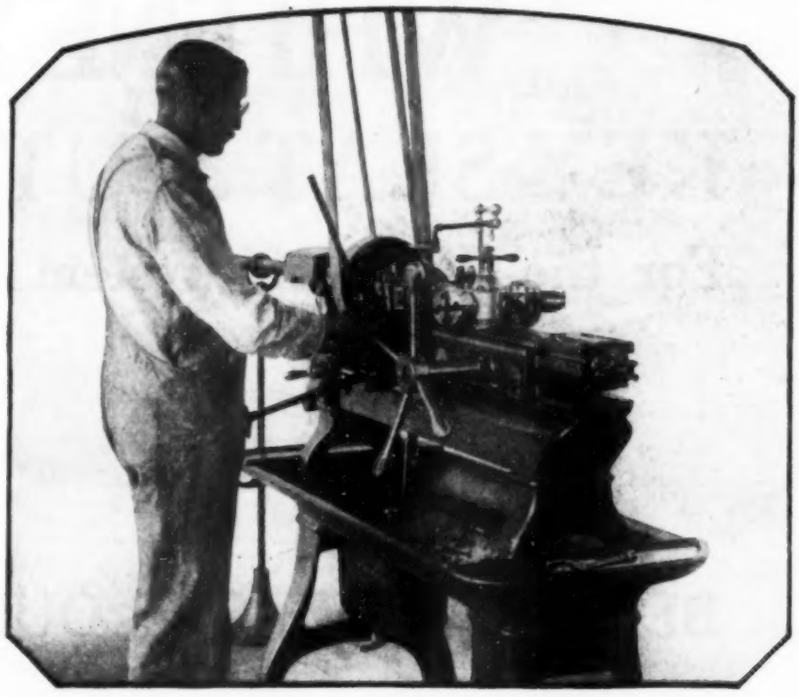
Production

Quantity is but one side of production — Quality is the other. In selecting equipment, ask "How many pieces of this machine's hourly production will be up to standard?" Long years of dependable performance have given Brown & Sharpe Machines an important place among the production equipment of shops the world over.



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Rapid production is secured on the smaller Brown & Sharpe Wire Feed Screw Machines by the control of all operations through two levers — one for each hand. Thus, the operator can attain high speed without fatigue.

To insure accuracy in the finished work, a vertical taper bolt rigidly locks the turret as each tool swings into position. This bolt, located near the edge of the turret and below the tool, accurately aligns each turret hole with the spindle.

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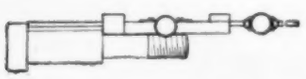

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On shouldered studs where the distance between shoulders must be right to a thousandth, your screw machine operators will appreciate Brown & Sharpe Vernier Depth Gauge No. 600. This tool is particularly well suited to measurements on pieces whose shape requires that the body and blade lie close to the work. No. 600 is also useful for all the ordinary work of a depth gauge such as measuring recesses, depth of holes, etc.

Your men will soon learn to rely on this dependable tool. See that your tool cribs are supplied with one or more of these Vernier Depth Gauges. Order from your dealer today.

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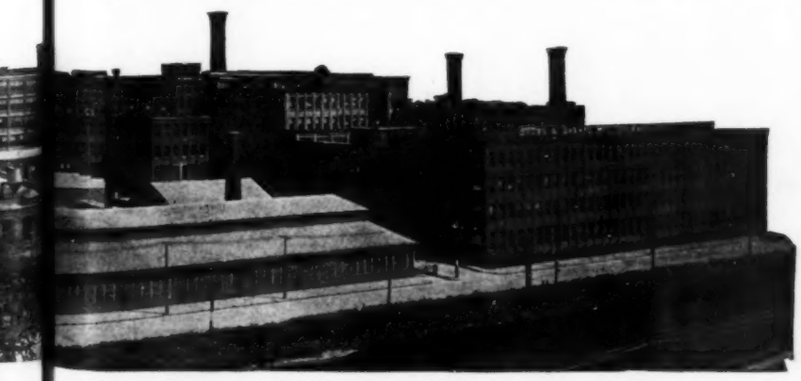

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Strom service is as good as we know how to make it. We have studied what manufacturers need. And we have adapted our service to their needs.

On orders for ball bearings from stock we can frequently make shipments the same day the order is received.

Where technical advice is needed, our corps of experts is at your service. They are familiar with every type of ball bearing installation ever made. We will be pleased if you will call on us.

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We believe in the golden rule in business. We give the kind of service that we like to get.

Double-acting thrust bearing, flat seats (grooved races) 2100-F Series

Single-acting thrust bearing, flat seats (grooved races) 1100-F Series

Single-acting, self-aligning thrust bearing 1100 Series

Single-acting, self-aligning thrust bearing, leveling washer. 1100-U Series

Double-acting, self-aligning thrust bearing, leveling washers 2100-U Series

Single-row deep-groove Standard type, radial bearing

Double-row, deep-groove Standard type, radial bearing

Angular contact bearing, combination radial and thrust

Double-row, maximum type, radial bearing

Single-row, maximum type, radial bearing

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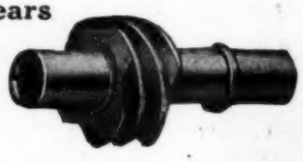

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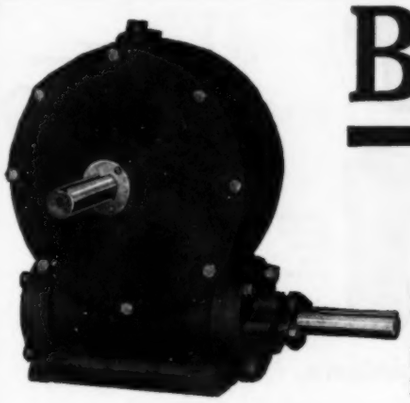

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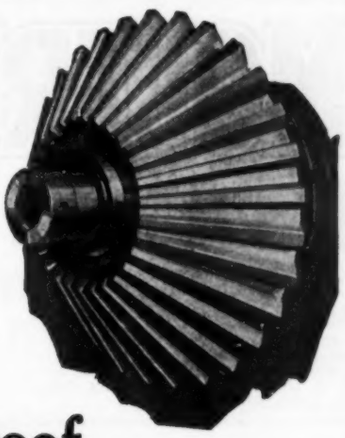

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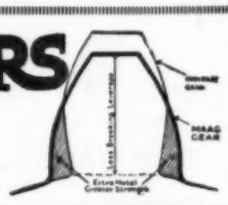

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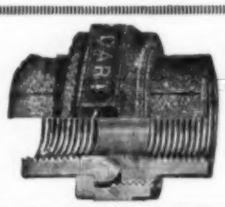

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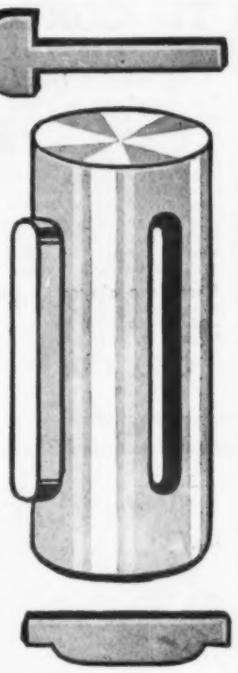

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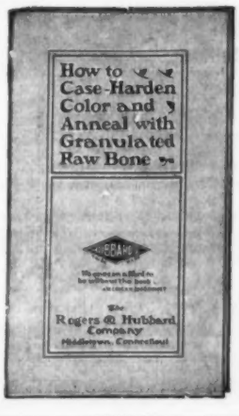

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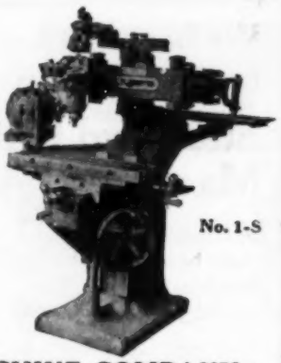

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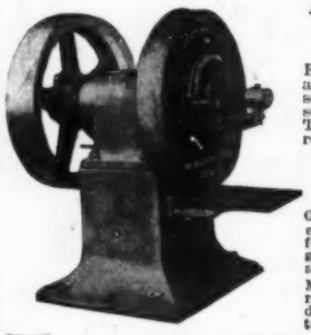

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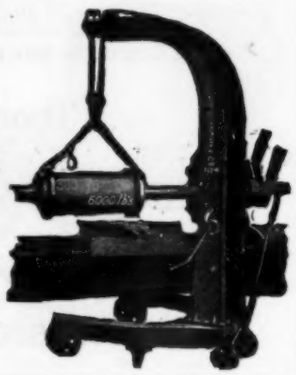

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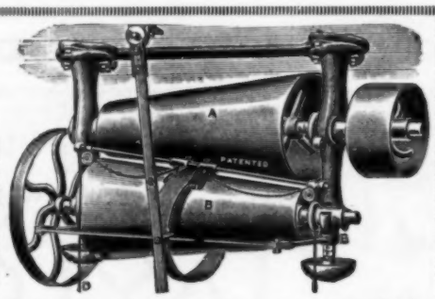

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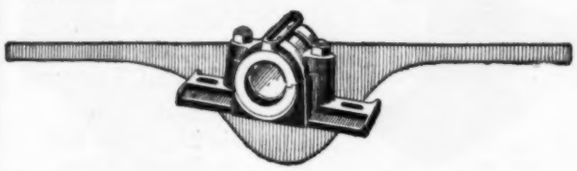

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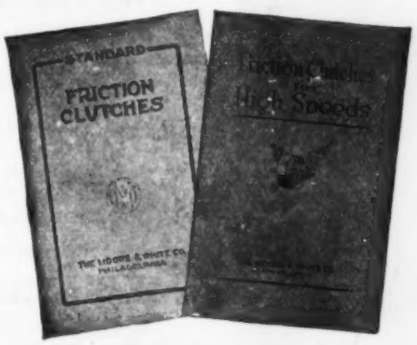

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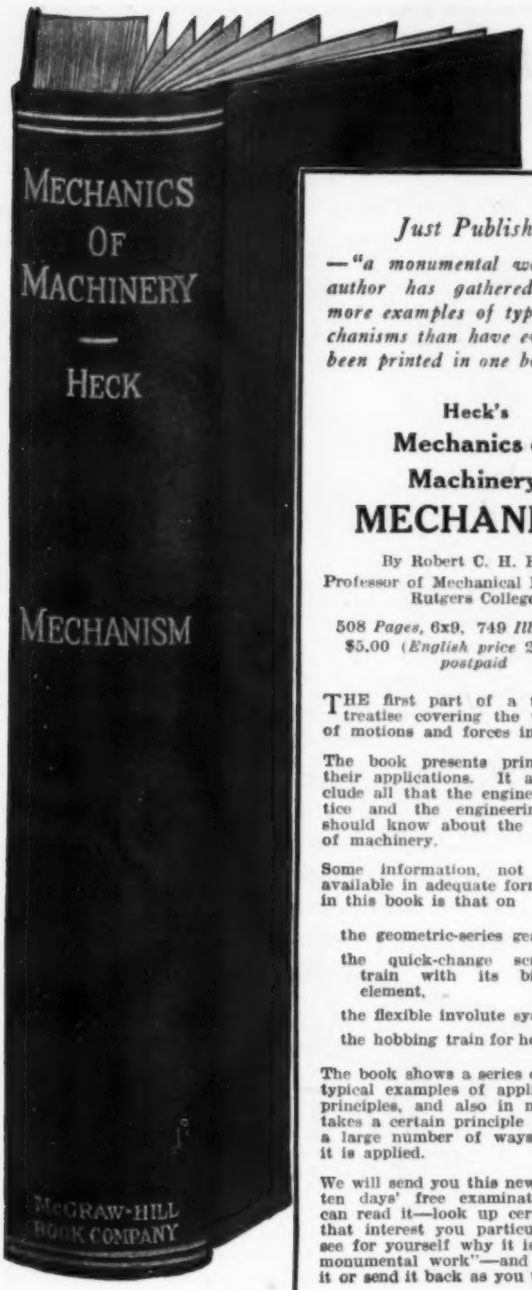

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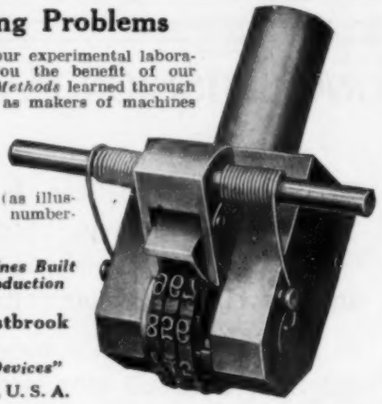

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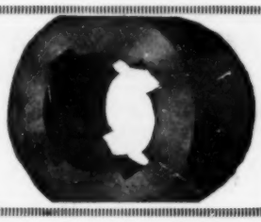

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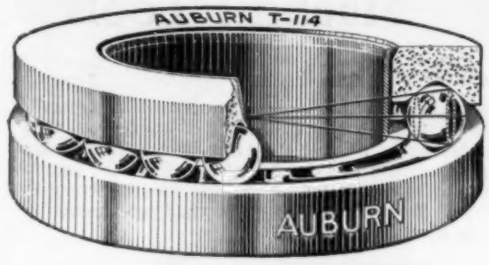

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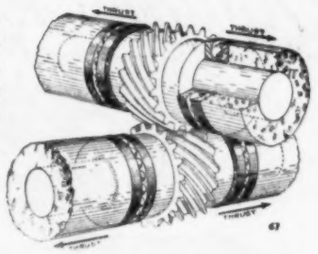

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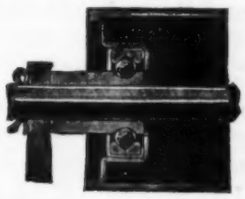

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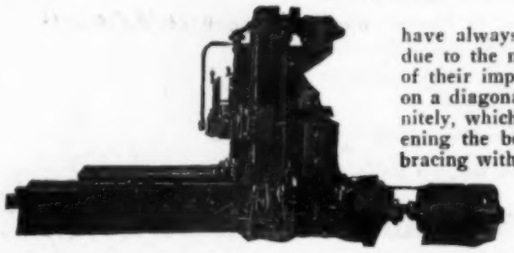

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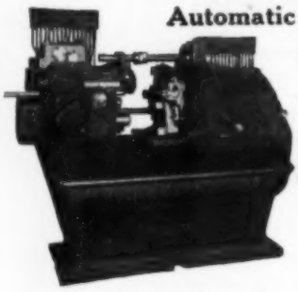

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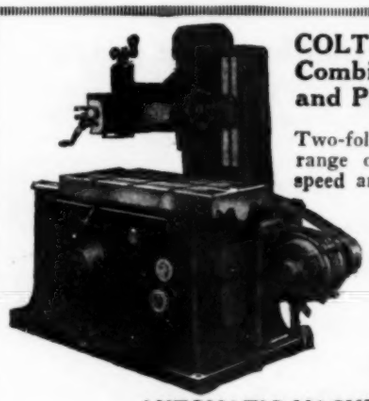

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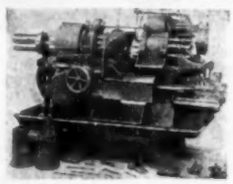

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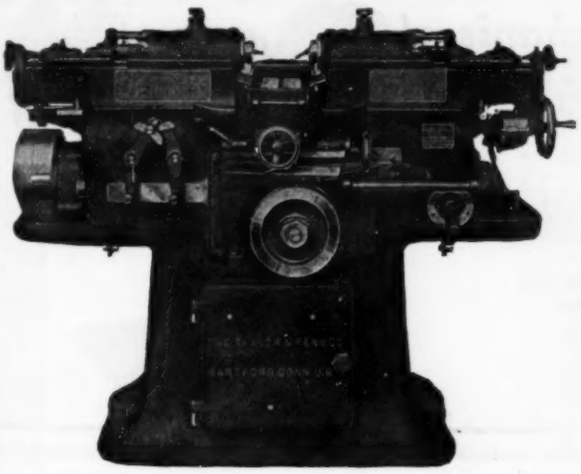

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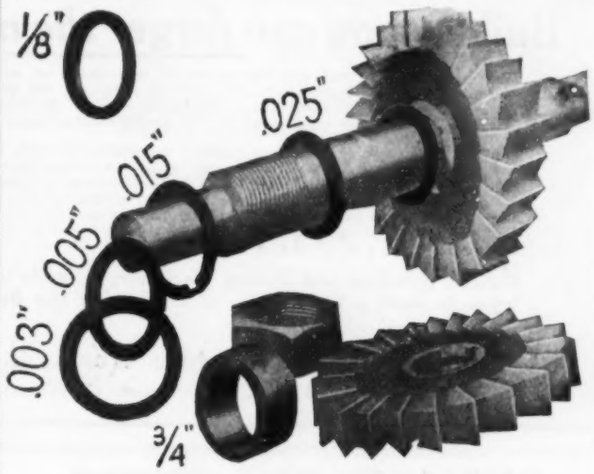

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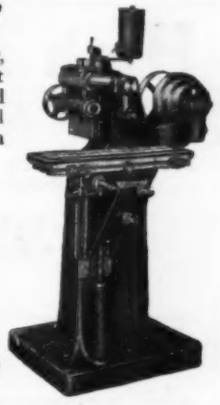

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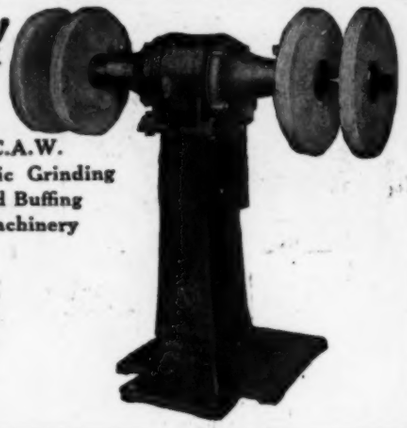

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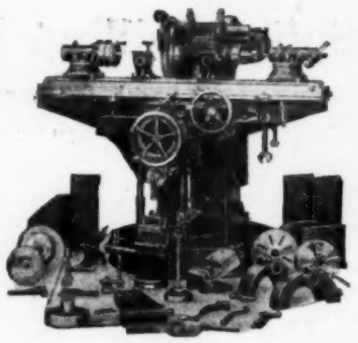

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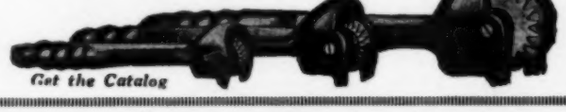

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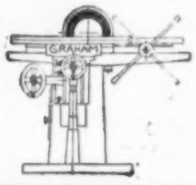

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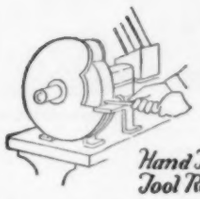

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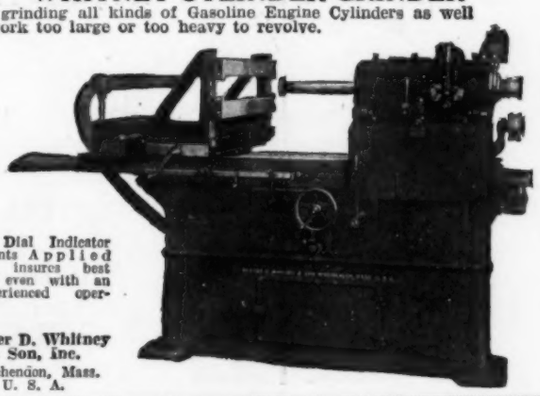

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is adapted to grind deep holes or small holes by the use of two different quill spindles. The machine is provided with large adjustable oil well lubricated bearings that insure smooth, cool operation and long life. Write for descriptive Bulletins.

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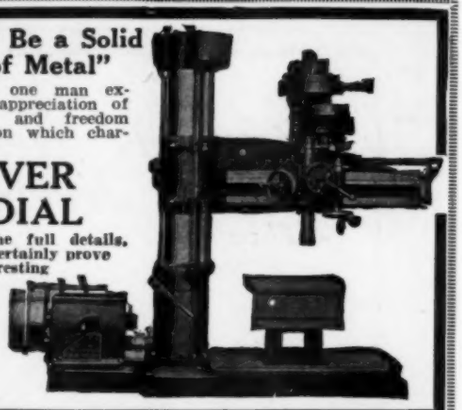

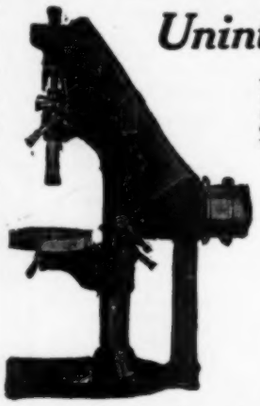

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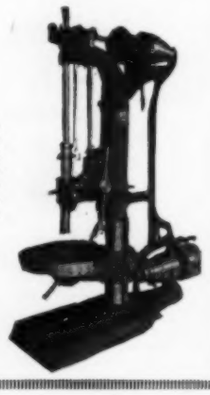

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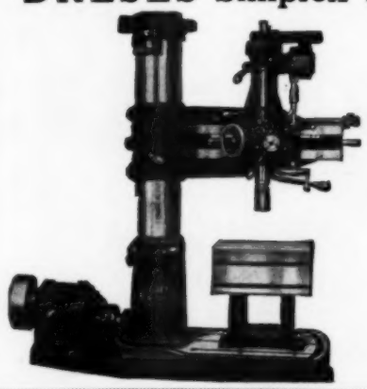

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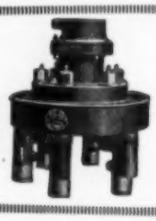

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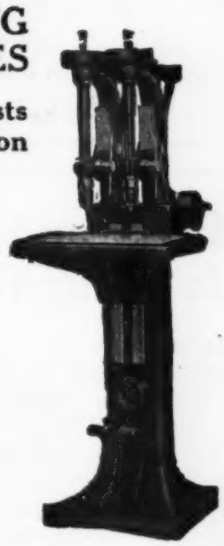

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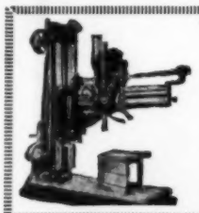

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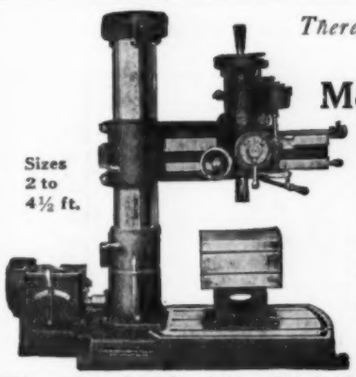

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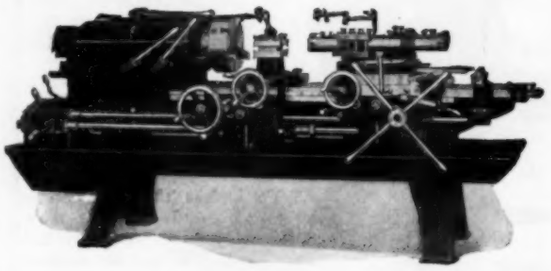

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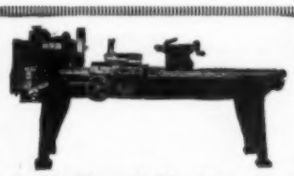

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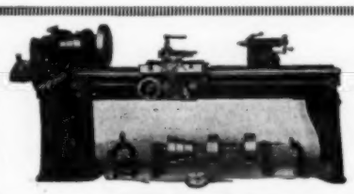

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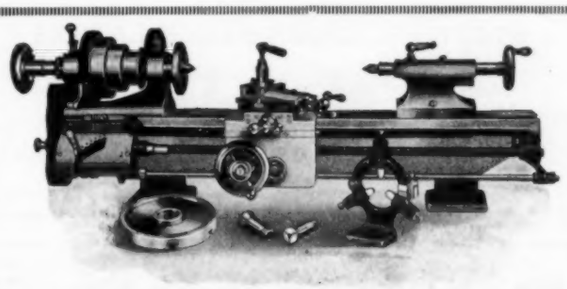

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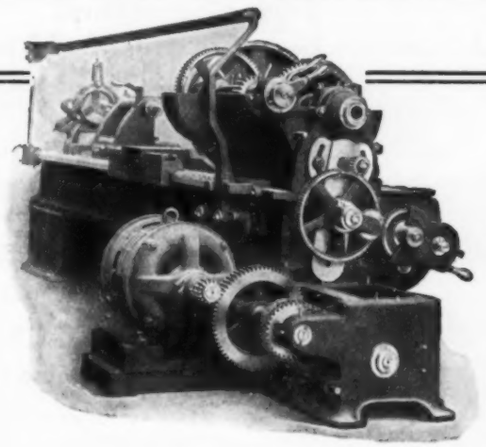

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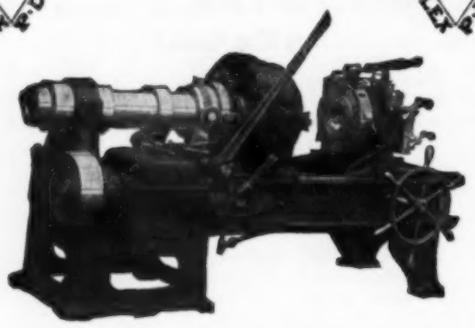

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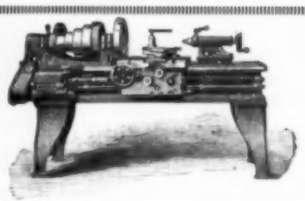

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13-15-17-19 in. Swing

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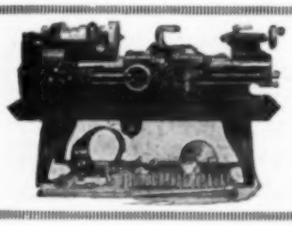
Established 1862



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All Sizes and Styles, from 9 inch to 30 inch Swing.

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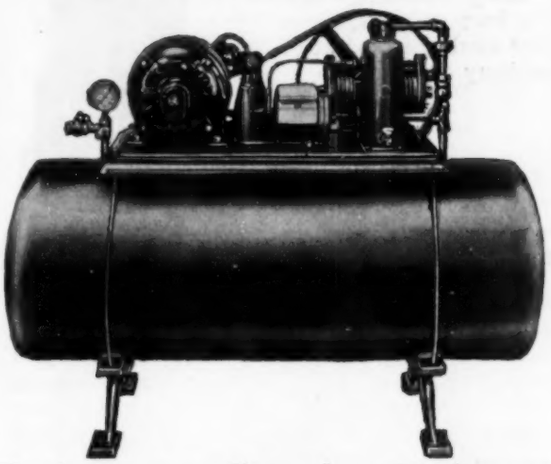

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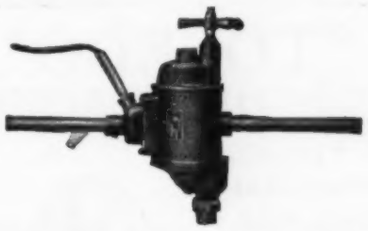

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EL-51

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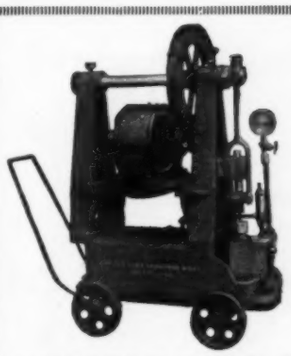

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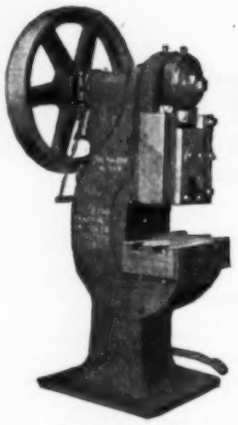

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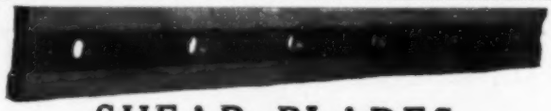

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"Saves an average of 50%"
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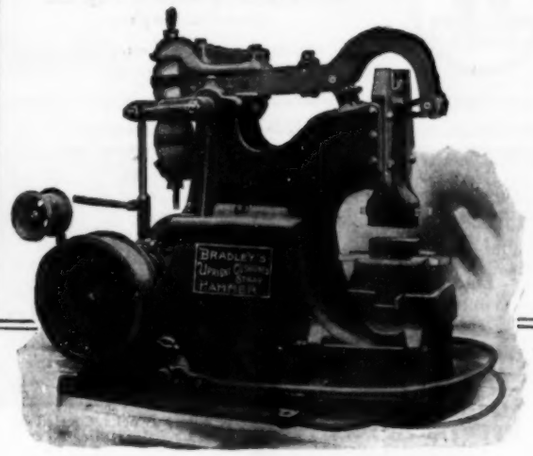

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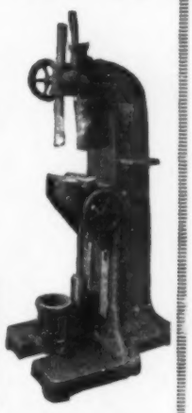

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Style	Size of work	Pressure Exerted
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(with or without truck) is powerful and easily operated and unbreakable.

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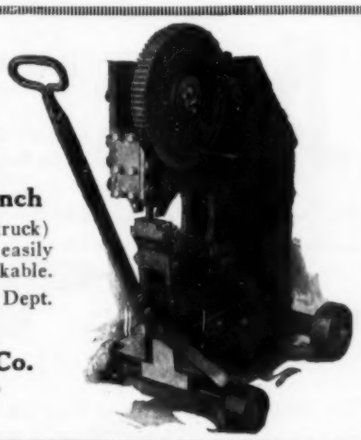

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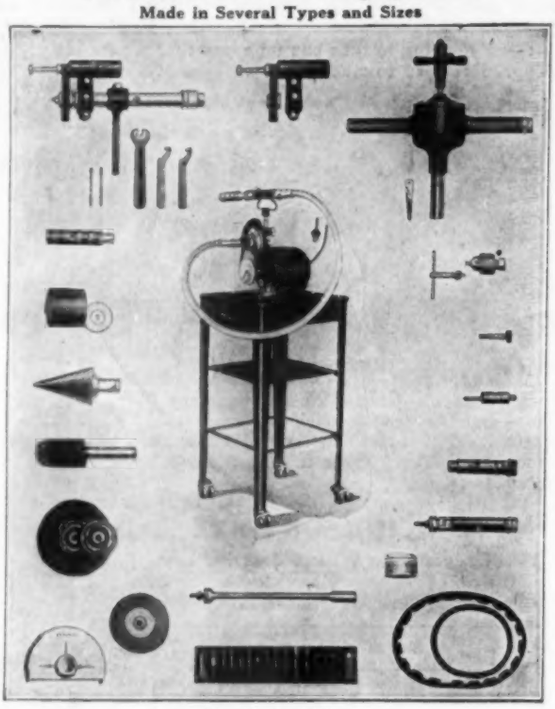

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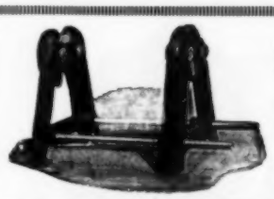

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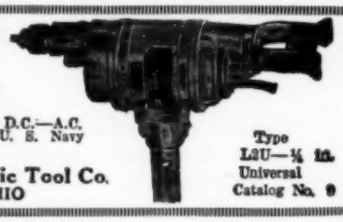

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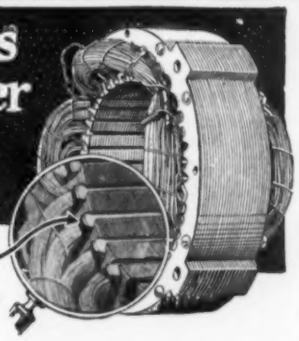
A Motor is no stronger than its insulation



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AC $32.00—Blount "Special"—DC $36.00
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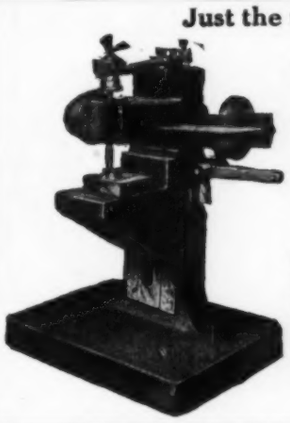
This ¼-hp. motor driven grinder and buff fully upholds the reputation which Blount products have acquired. The motor is of Westinghouse manufacture with interchangeable, wick-oiling, bronze bearings; and hardened steel spindle. The base, pan, flanges, and rest are of cast iron, in ample dimensions. Equipment includes 6-in. x ½-in. standard medium grit wheel; 6-in. x ⅝-in. cotton sewed buff; and flexible cord 8 ft. to 10 ft. long, with plug. Guards can be fitted at slight extra cost.

We offer this tool to the manufacturer as being ideal for "touching up" tools and a variety of small jobs, at negligible costs of operation.

Get the specifications

J. G. Blount Co., Everett, Mass.

Just the thing for small riveting



This rotating vibratory riveter is a light bench model that will speed up your production on small riveting up to ⅛ in. diameter. Easily operated by an apprentice or the most inexperienced female labor.

GRANT Riveters

are manufactured in many styles. There are **Noiseless Spinning Riveters, Multiple Spindle Riveters, Pneumatic Riveters,** and many other designs. Complete details are outlined in "Perfect Riveting." Send for your copy today.

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Hunter Saw & Machine Co.
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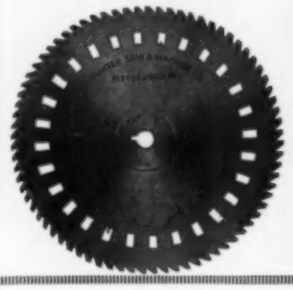

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Our machine puts polished heads on rivets by striking a multitude of light blows—80 to 1000 per second. It does not distort or upset the work at any point except the heads. Tremendous speed and perfect finish are the features. *Circular?*

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Another does 10,000—every head perfect. Alertness of the operator is the only limit to production.

They will do just as well, or better, on your work.

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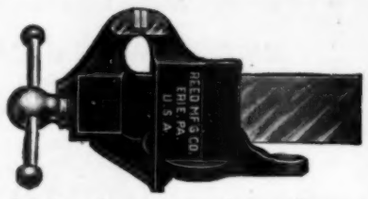
Strongest and Last Longest Most rigid vises you can buy.



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The quicker the "get away" on a job, the sooner will the work be finished. That's the reason why such high output figures have been obtained on the

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Set up time is almost negligible.

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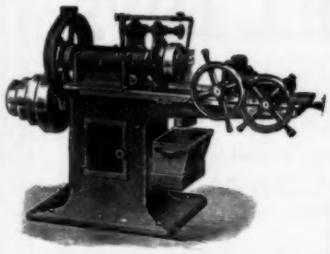

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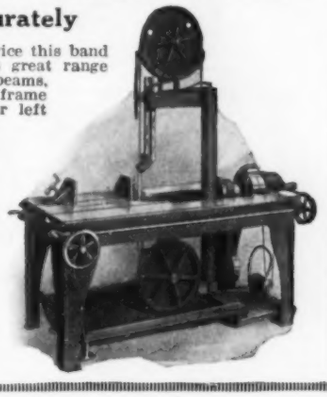

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Notice the big, roomy work table.

Put this band saw to work in your plant and your metal sawing problems are solved.

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Fast—Easy to Operate—Large Capacity
Minimum Waste of Stock

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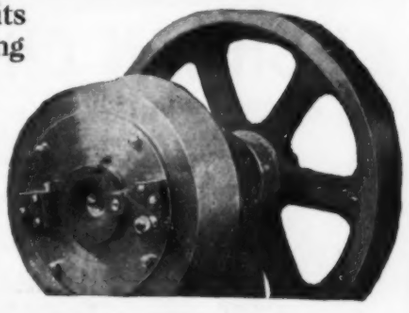

Are you taking advantage of modern machining methods? Swaging the Dayton way makes metal solid, tough and elastic. Daytons deliver from 2,000 to 6,000 blows per minute. *The details will convince you—get them.*

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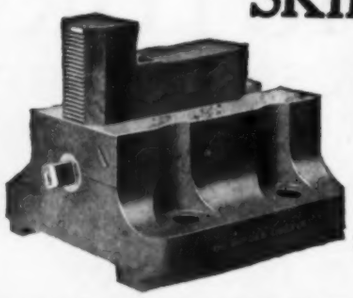
SKINNER BORING MILL JAWS



Note the powerful, compact construction of these sturdy jaws. For heavy duty work on boring mills and large lathes these jaws, fitted to the parallel slots in the face plate or table by means of the double rib, insure a most positive grip.

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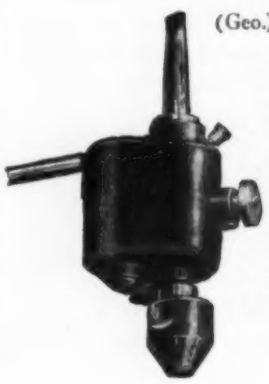

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"That 'shimmy' (oscillating) motion puts a tap right through the toughest steel—goes ahead a turn, then back off quarter turn—no breaking of taps—no friction to be adjusted." My men won't use any other kind now. "Say they can't make any premium time without it."

"Wahlstrom don't take much chance sending them out on 10 days free trial."

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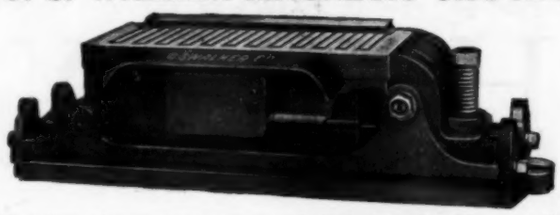
5520 Second Ave.
Brooklyn, N. Y.

O. S. WALKER MAGNETIC CHUCKS



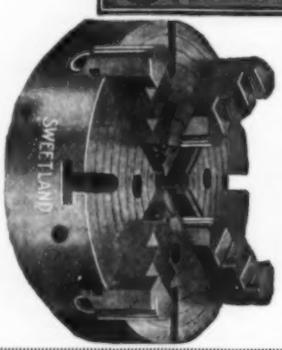
Save time, give greater accuracy and eliminate costly set ups on the holding of flat, taper, beveled and irregular shaped pieces. Made in a wide range of sizes and styles of the following types.

Rotary—Rectangular—Swiveling—Vertical Face

Write for full details

O. S. Walker Co., Inc., Worcester, Mass.

SWEETLAND CHUCKS



The body is ribbed to absolutely prevent buckling or spring under severe strain. Have you a *rcent* Catalog?

The Hoggson & Pettis Mfg. Co.
New Haven, Conn.

Horton Two-Jaw Drill Chucks

Simple — compact. Two jaws, single screw, solid body. Made for hard work and severe use. Seven sizes from 0-¼ in. to 0-2 in.

The E. Horton & Son Co., Windsor Locks, Conn., U. S. A.

CUSHMAN CHUCKS

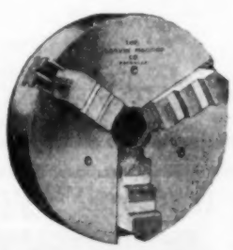
4 Jaw Independent Type
"The Incomparable"
also
Self-Centering (Geared Scroll Type)
2 Jaw Lathe Chucks
"The Hartford" Drill Chucks

WRITE US FOR BOOKLET "The Incomparable"

THE CUSHMAN CHUCK CO. HARTFORD, CONN., U.S.A.

A Report On GARVIN Wrenchless Chucks

from a large brass goods plant advises a 50% reduction in cost by the use of these chucks. Is this not worth while investigating at your plant?



Two and Three Jaw Carried in Stock

For Further information { Ask Your Dealer or Write Us Direct

Full description in Chuck Catalog

The Garvin Machine Company
Spring and Varick Sts. 50 Years in New York City

Graduated Adjustable Friction Self-Centering

Tap Holders for Turret Lathe

TAPS STEEL as safely as Cast Iron

Regulates the Whole Power of Machine to Just Drive, but Cannot Break Tap. When Tap Sticks (or Strikes Bottom) the FRICTION SLIPS, and Tap can thus be Run In and Out until the Toughest Metal is Quickly Tapped.

Interchangeable Spring Shanks for Rough and Finish Taps occupying One Turret Hole.

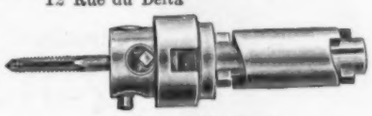
ERRINGTON

MECHANICAL LABORATORY

BROADWAY and JOHN ST., NEW YORK

Phone Cortlandt 3149

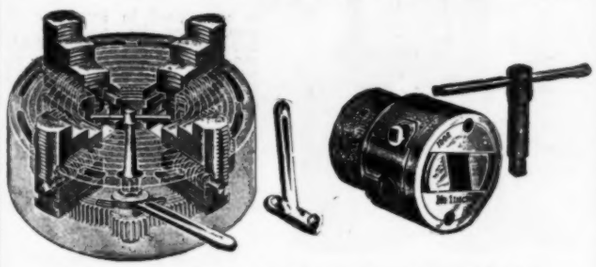
New England Branch: 831 Old South Building, Boston, Mass.
Catalog Francais: Edgar Bloxham, Paris
12 Rue du Delta



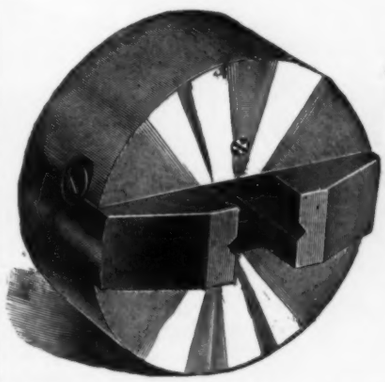
Double Clutch Sleeve

Especially Good for Roughing and Finishing Taps, Running Solid Dies Up Against a Shoulder, etc.

Westcott Chucks— Lathe and Drill



Westcott Chuck Co., Oneida, N. Y.



Whiton Chucks

for all purposes

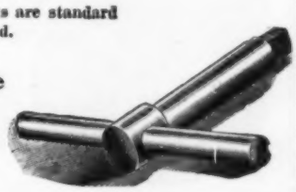
This is the two-jaw Whiton: Easily cleaned—Wide range

Ideal in its particular field because of its super grip and the fact that the screw threads extend to the outside face giving the greatest possible range. Adjustment is a matter of seconds, and once set there is only one way to loosen its grip—that is by a turn of the key. The body is machined from a solid block of steel—no seams—no weak places, to give under strain. The jaws have hardened steel thrust shoulders, and as the cut shows, are of very ample proportions.

Write for details. Whiton Chucks are standard throughout the world.

D. E. Whiton Machine Company

New London, Conn.



The Ney "Positive Grip" replaces eighteen ordinary collets

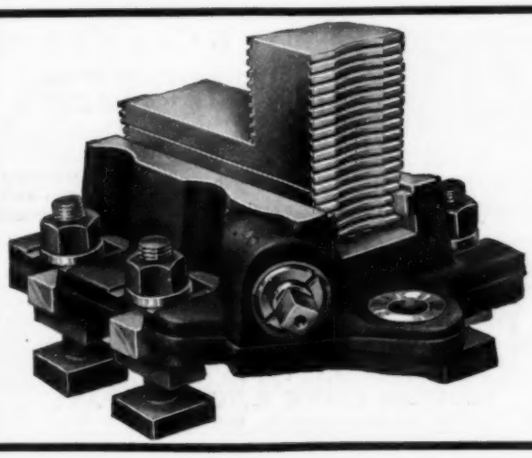
The six, interchangeable one-piece spring tempered jaws of the **NEY "POSITIVE GRIP" COLLET CHUCK**, covers the range of eighteen ordinary collets.

Think of this feature of economy, plus the satisfaction of having this versatile tool that "fits in" on hundreds of small jobs that come up in tool room practice.

And a big point, it never mars the work.

Write for our illustrated leaflet, showing its wide application.

The J. M. Ney Co., Hartford, Conn.



An Unfailing Hold

Bullard Face Plate Jaws are relentless in their grip under heaviest cuts. The Body is Drop Forged Steel—Top Jaws Special Analysis Steel. The actuating screw is set at an angle with the thrust to provide against any chance of slippage.

Bullard Jaws are designed for dependable service.

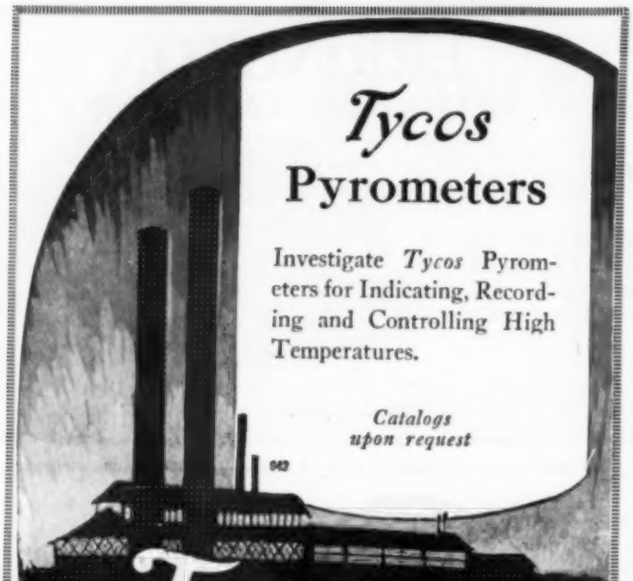
BULLARD

Bridgeport, Conn.

Tycos
Pyrometers

Investigate *Tycos* Pyrometers for Indicating, Recording and Controlling High Temperatures.

Catalogs upon request



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Temperature Instruments
INDICATING-RECORDING-CONTROLLING
Taylor Instrument Companies
Rochester, N.Y. U.S.A.
Canadian Plant
Tycos Building, Toronto, Canada
There's a Tycos or Taylor Instrument for Every Purpose

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Indicators and Gauges

for every kind of precision measurements on duplicate parts. Quickly and easily applied. Unsurpassed in simplicity and durability.

Calibrated in thousandths of an inch or metric scale. Ideal for the rapid, accurate inspection of large quantities of work. No modern shop should be without them.

Write us today.

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Waltham, Mass., U. S. A.

International Standard Scleroscope (Hardness Tester)

The Scleroscope

is now used in hundreds of plants for its accuracy in hardness testing. It is direct reading and can readily be operated by anyone. Ranges from softest metals to hardest steels without adjustment. It is invaluable in ordering materials to specifications. The free booklet will interest you.

The Shore Instrument & Mfg. Company
Van Wyck Ave. and Carrl St.
Jamaica, N. Y.

We Make Nothing But Chucks

Union Chucks are always "up to the minute." Our entire efforts are devoted to the development of chucks and every dollar expended in a Union assures ample returns in service. Correct design and proper materials give Union Chucks the stamina to stand hard usage.

Union Manufacturing Co.
26 Cortlandt St., N. Y.
New Britain, Conn., U. S. A.
Makers of a Complete Line of Chucks

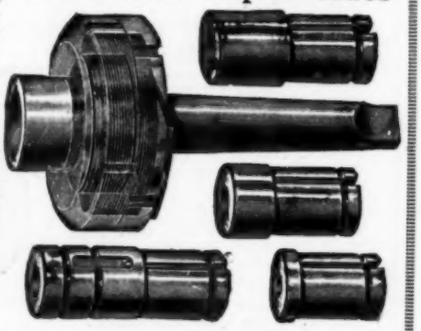
Our Catalog shows full line. Send for your copy.

The Safety Drill and Tap Holder

is the only attachment for the purpose that gives universal satisfaction and is Unequaled for Efficiency, Convenience, Rapidity, Accuracy and Simplicity.

Can be furnished with special sockets with friction set to carry one or two sizes of taps, useful if sizes are constantly changing.

Nothing to *break* or get out of *order*. Made in 4 sizes covering, from 0 to 2½ in diameter.



The Beaman & Smith Co., Providence, R. I., U. S. A.
Builders of Boring and Milling Machines, and Special Machines for such Purposes Constructed.

Almond PRODUCTS

Geared Drill Chucks
Standard Drill Chucks
Independent Lathe Chucks
Geared Scroll Lathe Chucks
Combination Lathe Chucks
Right Angle Transmission
Flexible Steel Tubing
Flexible Arms
Micrometers
Fine Mechanical Tools

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T. R. *Almond* Mfg. Co., Ashburnham, Mass.

Model B (Five wheels)
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MODEL B GEAR COUNTER
will give you your accurate production. Tested 20,000 per hour.
Send for circular

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RAPID *Slip Drill CHUCK*
Drives Straight and True
Cannot Injure the Collet

American Equipment Company, Detroit

CHUCK WITH AIR

The Lavoie Air Chucks are very simple in construction and are easy to operate. The grip is absolutely certain, as is the release. Made in seven types with six styles of jaws.

Write for particulars.

FRONTIER CHUCK & TOOL COMPANY
34 Letchworth St., Buffalo, N. Y.

ALLEN Safety Set Screws

30% Extra Strength over broached hollow screws—the only other kind made. By a patented process we increase the density of the steel around the socket-holes, so that even the smaller sizes will stand all the strain the best made wrench can apply. The Allen process makes deep, perfectly-formed socket-holes—no chips in the bottom. The entire length of the ALLEN is utilized either for solid metal at the point, or depth of socket for the wrench. All sizes in stock from ¼ in.; to 1½ in.; any length, point or thread. Also Pipe Plugs Socket Head Cap Screws, Tap Extensions and Tire Wrenches—Allen process. Complete descriptive catalogue on request.

THE ALLEN MFG. CO. 129 SHELDON ST. HARTFORD, CONN

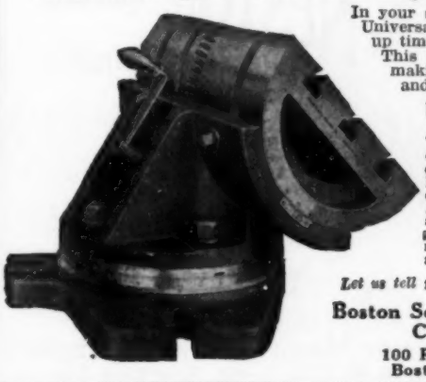
SMOOTH-KUT

The only helical flure EXPANSION REAMER ever produced.

The greatest EXPANSION REAMER ever produced. 1924 is a SMOOTH-KUT year. This tool is sold under absolute guarantee as the greatest EXPANSION REAMER *ever placed on the market.*

MILLERSBURG REAMER & TOOL CO.
MILLERSBURG, PA.

Eliminate the "Cut and Try" Method!



In your shop with a Boston Universal Angle Plate. Set-up time is non-profit time. This tool eliminates the making of costly jigs and fixtures.

UNIVERSAL Angle Plate

Converts a Plain Machine into a Universal. Equally good on tool or production work. Any angle instantly available — Vernier graduations insure utmost precision. Heavy and rigid.

Let us tell you more about them.

Boston Scale & Machine Company
100 Ruggles St., Boston, Mass.

Summed Up in the Production-Report

Hold the yardstick on your machine's *usefulness.* Get the measure of its value as a *producer.* Gauge the skill of your operating methods, and the energy of the operator where this is a factor. You'll have a report on them all—automatically—from a

Veeder COUNTER

The large Set-Back Revolution Counter above records the output of any machine where a shaft-revolution indicates an operation. Sets back to zero from any figure by turning knob once 'round. Supplied with from four to ten figure-wheels, as required. Price, with four figures as illustrated, $10.00—subject to discount. Equipped with lock and keys to prevent tampering with the record, $2.00 extra (*Cut ½ size.*)

Write for the 80-page counter booklet.

THE VEEDER MFG. CO.

51 Sargeant Street Hartford, Conn.

Here's "automatic" skill

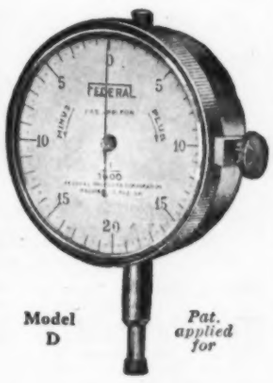
This Model D Federal Dial Indicator

is more accurate and more economical than "human" skill.

The dial is graduated in .0005 in., making it easy to detect errors of .00025 in. or less.

It is designed particularly to withstand the strenuous conditions of regular shop service.

Let us send you the bulletin showing the complete Federal Line.



Model D

Pat. applied for

Federal Products Corporation
Providence, R. I., U. S. A.

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FOR
INCREASED PRODUCTION
DURABILITY and ACCURACY
COWLES TOOL COMPANY
Cleveland, Ohio
Cutter Designers and Manufacturers

TAYLOR-NEWBOLD SAWS
and
MILLING CUTTERS

The Tabor Manufacturing Company
Philadelphia, Pa.

TRADE MARK DELTA

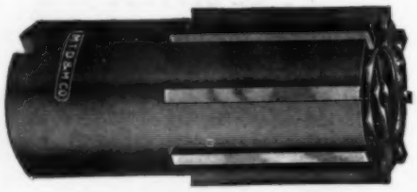
DELTA FILES

HIGHEST GRADE FILE MADE. THE FILE YOU WILL EVENTUALLY USE

FILES OF QUALITY

DELTA FILE WORKS, Philadelphia

Blind Holes Can Be Reamed *with* "MORSE" One Lock Reamers



They can be adjusted from 1/64 inch to 5/64 inch, according to size. The adjustment is quick and positive, and the work done is accurate. Made with either Carbon or High Speed blades.

THE GENUINE MORSE DRILLS ENCIRCLE THE GLOBE

MORSE
TWIST DRILL & MACHINE CO.
NEW BEDFORD, MASS. U.S.A.

Why H & G *Dieheads Always* Produce

1. Chasers are hobbed. Hobbed chasers fit the screw as a nut fits the lead screw. This is the only correct method by which accurate results can be secured.

2. H & G chasers are hobbed with Hanson Hobs. Hanson Hobs are finished after hardening, accurate in lead and thread form and perfect in finish—all of which is reproduced in the threads cut by H & G chasers.

3. The chasers are supported in the diehead by cams directly over the cutting point and cannot give under the strain of cutting.

4. The entire body and all parts of H & G Dieheads are hardened and accurately ground. Chaser slots are tested with go and no-go gauges having less than one-thousandth difference.

New 96-page Catalog

This new miniature catalog contains much valuable information relative to thread cutting in addition to a complete description of H & G Dieheads which are adaptable to all machines.

THE EASTERN MACHINE SCREW CORPORATION
22-42 Barclay Street, New Haven, Conn.
Die Heads That Revolutionized Threading

H&G

NATIONAL CLEVELAND
"Extra Service" Tools
Milling Cutters, Spur and Worm Gear Hobs, Reamers, Interchangeable Counterbores, Special Tools.

The National Tool Co., Cleveland, Ohio
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The Nestor File Handle is a light steel stamping, formed to fit the hand. The positive wedge grip fits any file up to 8-in. size.

Grips tightly—no danger of injury from sharp tangs—yet can be easily removed—they never have to be discarded.

So moderately priced that every factory using small files can afford to have a handle for every file.

Try them out in your own shop. Send $1.00 for a trial order of 36. Interesting discounts to Dealers.

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TAPS and DIES

REGISTERED TRADE MARK C

The Famous "Carpenter Quality"
The Choice of Experts—make it yours!
J. M. Carpenter Tap and Die Company
Oldest Tap and Die Makers in America
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TWIST DRILLS, CUTTERS, REAMERS AND SPECIAL TOOLS
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Twist Drills, Reamers and Special Tools
THE BUCKEYE TWIST DRILL CO., ALLIANCE, O.
Chicago Office, 542 West Washington Blvd.

A slight tap on the locking wedge will positively lock a

LOVEJOY
Inserted Cutter Tool

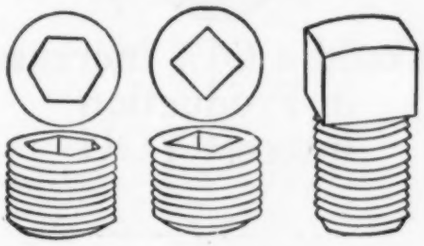
When locked, the Lovejoy is as rigid as a solid forged tool. Yet it is adjustable for wear, which means that it **lasts three** or **four times as long** as a solid tool—a real economy worth investigating.

Let us send you our catalog and price list.

LOVEJOY TOOL COMPANY, INC.
SPRINGFIELD, VERMONT, U.S.A.

AGENCIES:
The Chadwick Co., 549 W. Washington Blvd., Chicago, Ill. For British Isles: Selby Engineering Co., 92 Fenchurch St., E. C. 3. For France, Belgium and Spain: F. Auberty & Co., 182 Rue Lafayette, Paris, France.

What's the matter with these set screws?



They easily loosen
They split and crack
They mushroom

because they expand when they are tightened by the wrench—

And that is where

TRADE MARK
BRISTO
REG. U. S. PAT. OFFICE

Safety Set Screws Differ

They actually **contract** when tightened and the metal **expands** when the wrench is released, which action automatically locks them in place so that they cannot loosen. Do not mushroom, crack, split or fail from any cause. Special heat treated steel.

Send for Bulletin B-810

The Bristol Company, Waterbury, Conn.

Branch Offices:
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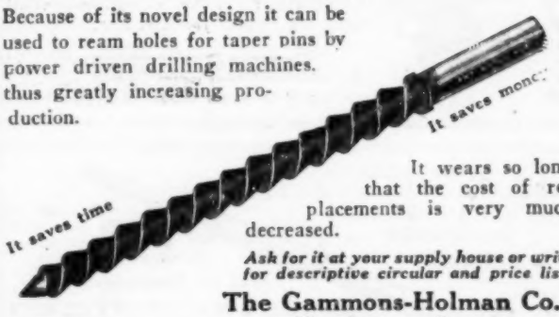
Cutters for every conceivable operation from plain milling to complicated gang cuts. Standard cutters of all kinds carried in stock. Specials to your specifications from blue prints.

The Sommer & Adams Co.
18511 Euclid Ave., Cleveland

The Gammons Taper Pin Reamer

Because of its novel design it can be used to ream holes for taper pins by power driven drilling machines, thus greatly increasing production.



It wears so long that the cost of replacements is very much decreased.

Ask for it at your supply house or write for descriptive circular and price list.

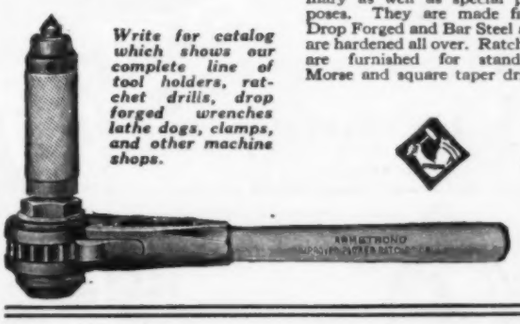
The Gammons-Holman Co.
Manchester, Conn.

ARMSTRONG
RATCHET DRILLS

Every shop finds occasions where hand drilling is quicker and more economical than machine drilling, and every shop should be equipped with Armstrong Ratchet Drills.

Armstrong Ratchet Drills are built in styles to meet all ordinary as well as special purposes. They are made from Drop Forged and Bar Steel and are hardened all over. Ratchets are furnished for standard Morse and square taper drills.

Write for catalog which shows our complete line of tool holders, ratchet drills, drop forged wrenches lathe dogs, clamps, and other machine shops.



ARMSTRONG BROS. TOOL CO.
"The Tool Holder People"
315 N. Francisco Ave., Chicago, U. S. A.

Would a 64% Increase in Production Interest YOU

—particularly if this were possible solely by the adoption of a new development in screw cutting oil?

In a recent 30-day test at the plant of one of the largest and foremost manufacturers of automobile equipment in the world

D. A. STUART & CO.'S

"SUPER-KOOL"

SCREW CUTTING OIL

proved of such unexpected value in one of the largest departments, its use was immediately extended throughout the plant. (Name furnished on request.)

While it is not always possible to show a 64% increase in production through the use of Stuart's "Super-Kool" IT IS POSSIBLE in practically every case to substantially reduce costs and to improve shop conditions.

Can YOU afford NOT to test this remarkable new development? Order a trial drum of "Super-Kool" Base today! Stipulate on your requisition that the oil is not to be paid for unless found 100% satisfactory in handling your particular requirement.

D. A. STUART & CO., Inc.

2733 S. Troy St., Chicago, Ill.

ESTABLISHED 1865

Warehouses in Principal Cities

Style D. Style G.

You can't expect service from bearings—

if they are choked up with grit and dirt. There's one sure way to keep them clean—Fit Tucker Oil Hole Covers.

Catalog on request.

W. A. & C. F. TUCKER, Hartford, Conn., U. S. A.

FOREIGN AGENTS: Fenwick Freres & Co., Paris, France
Alfred Herbert, Ltd., Yokohama, Japan

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Give perfect satisfaction where others fail. State style and size in which you are interested, and we will send free samples and catalog.

Gits Bros. Mfg. Co.

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For Convenience Economy, Construction

and long lasting qualities the

Bennett Handy Top Oil Cups

have no superior. The attached top cannot be mislaid or lost and when in place is positively dust proof. Made for thread or drive fit in styles and sizes to suit your needs. Catalog M shows our full line—send for copy.

BAY STATE STAMPING CO.

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MINOLARD

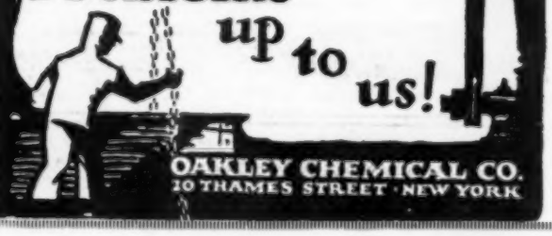
If you are sincerely interested in cutting costs with a universal cutting oil—let us send a generous sample of Minolard—made by the makers of "Economy" grinding lubricant. Just a postcard will do—mail it today.

The White & Bagley Co.

Worcester, Mass., U. S. A.

OAKITE CLEANS

Put your Cleaning Problems up to us!



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Don't Waste Oil

On Countershafts and Loose Pulleys. Eliminate them by using Mule-Pull Clutches. *Send for circular.*

Brown Engineering Co.

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CAMPBELL INTERNAL KEYWAY CUTTER FOR USE IN DRILLING MACHINES

Is a Revelation in Compact Machine Tool Construction

It costs so little but does the work of an expensive machine.

Send for Particulars

CAMPBELL MACHINERY CORPN.

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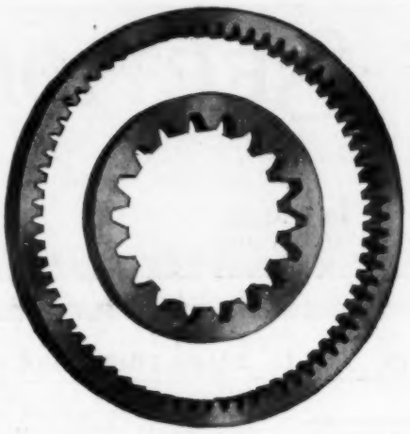

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Prompt service and deliveries when manufactured by

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of
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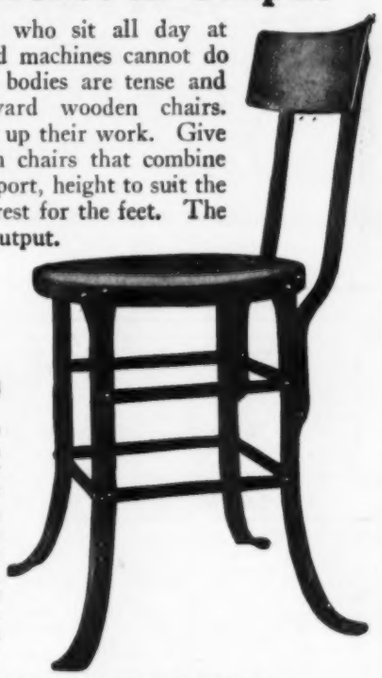
Makers of Broaching Machines and Broaches.

Chairs *Do* Make A Difference in Output

Men and women who sit all day at tables, benches and machines cannot do their best if their bodies are tense and tired from awkward wooden chairs. Such fatigue slows up their work. Give them comfort with chairs that combine full, snug back support, height to suit the work and an easy rest for the feet. The result—increased output.



METAL MEECO PRODUCTS

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Meeco Steel Chairs cost you less than two cents per day per dozen with our five-year guarantee. Could you buy good wooden chairs and keep them repaired five years for that price? The investment is an economy from the start.

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District of Columbia

EXPERIENCED mechanical engineer with technical knowledge, thorough draftsman, familiar with worm gear and machine design. Progressive company located Baltimore vicinity. State fully previous experience and salary desired. P-722, American Machinist, Real Estate Trust Bldg., Phila., Pa.

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EXECUTIVES, engineers and other qualified men whose salary requirements are over $2,500 per year, find our confidential direct service to specific employers extremely satisfactory. An inquiry entails no obligation. The National Business Bourse, Inc., H. H. Harrison, President, Association Building, Chicago.

OVERTURES negotiated through the confidential correspondence service of the undersigned, for salaried positions $2,500 to $25,000—executive, mechanical, administrative, engineering, technical, financial, manufacturing, sales, advertising, professional, etc., etc.; all lines. Established fourteen years; not an employment agency. Our "Refund Contract" guarantees refund of retaining fee to client named therein, if service is not satisfactorily rendered and refund be requested within three months from date remitted. Send name and address only for particulars. R. W. Bixby, Inc., 703 Lockwood Building, Buffalo, New York.

EMPLOYMENT AGENCIES

NATIONAL CLERICAL BUREAU, Wisconsin's only technical agency, offers special opportunity to technical men to locate in Milwaukee and vicinity, where diversified industries assure both opportunity for advancement and steady employment. No advance fee. Loan & Trust Bldg., Milwaukee, Wis.

POSITIONS WANTED

Illinois

SUPERINTENDENT or works manager, 12 years' experience as factory executive in the manufacturing of automotive hardware and metal specialties; familiar with stamping machining assembly tools, dies, centerless grinding and sheet metal work; location immaterial. PW-734, Am. Mach., Old Colony Bldg., Chicago, Ill.

Indiana

I AM A practical mechanic, 32, technical education, twelve years' of practical experience, including, tool and die making, designing production tools and fixtures, executive, wide experience in developing, design and building automatic machinery, located in Middle West; available Feb. 1. Interview preferred. PW-721, American Machinist, Old Colony Bldg., Chicago, Ill.

FOREMAN WANTED

For Punch Press Department

By plant manufacturing small sheet brass and steel products. Must be thoroughly experienced on draw and stamping work. Must be an executive and producer. Give full particulars in your reply, age, class of work done and salary expected.

P-727, American Machinist
1570 Old Colony Bldg., Chicago, Illinois

POSITIONS WANTED

Massachusetts

MACHINE shop superintendent or foreman, practical, mechanical engineer, 28 years' experience, good organizer, knows how to get results; well up in erecting engines, pumps and machinery. Would consider position abroad. Age 47. PW-729, Am. Mach., 10th Ave. at 36th St., New York.

New York

ALLROUND machinist (42), with some executive training and experience, wishes position of responsibility and trust in small American community having exceptional good schooling facilities. Location preferably in the Middle West or West. PW-708, Am. Mach., 10th Ave. at 36th St., New York.

DESIGNER and manufacturing executive on high grade electrical and mechanical apparatus; long and broad development, installation and sales experience; M. E., member A.I.E.E. PW-730, Am. Mach., 10th Ave. at 36th St., New York.

SUPERINTENDENT or general foreman, with fifteen years' practical shop experience in punch and dies, jigs and fixtures, inspection, adding machine construction, experimental work and maintenance work; age 34 years; can give best references. PW-711, American Machinist, 10th Ave. at 36th St., New York.

New Jersey

GENERAL foreman of machine shop wishes position with a reliable firm; A-1 mechanic, with broad experience; good on production and handling of help; best of references. PW-738, American Machinist, 10th Ave. at 36th St., New York.

Pennsylvania

MECHANICAL draftsman and designer desires position; wide experience on general automatic machinery, jigs, fixtures and tools; American; capable executive, with thorough shop training. PW-735, Am. Mach., Real Estate Trust Bldg., Philadelphia, Pa.

Wisconsin

MAN, experienced, and well acquainted with industries in Milwaukee and State, wishes to represent manufacturer, in small tools, machinery or similar lines. PW-732, Am. Mach., Old Colony Bldg., Chicago, Ill.

Factory Executive

Broad experience and wide acquaintance in the metal working industry. My experience has been gained during twenty years in five plants, holding positions as Works Manager, Sales Manager and General Superintendent. Their combined forces would total fifteen thousand employees and included the following departments, Iron Foundry, Drop Forge, Press Steel, Nickel Plating, Enameling, Automatic Screw and both Unit and Progressive Assembling. Married and enjoy exceedingly good health. Will go anywhere in the Eastern States.

PW-704, American Machinist
10th Ave. at 36th St., New York City.

SPARE TIME WORK WANTED

M. E. EXPERT in developing ideas, machines, fixtures, cutting manufacturing cost. Desire spare time work. STW-599, Amer. Mach., 10th Ave. at 36th St., New York.

AGENCIES WANTED

General Sales Engineers

with New York headquarters open for sales agency of a marketable engineering products of broad application. AW-731, Am. Mach., 10th Ave. at 36th St., New York.

SALESMEN AVAILABLE

SALESMAN, practical mechanic with wide executive experience; will handle a real mechanical proposition. Salary or commission. Western New York preferred. SA-733, Am. Mach., 10th Ave. at 36th St., New York.

POSITION on sales force of some reliable manufacturer of machinery, tools or special line, by man, age 28, with machinery, office and sales experience. SA-736, Am. Mach., Leader-News Bldg., Cleveland, Ohio.

PATENT ATTORNEYS

PATENTS. C. L. Parker, patent attorney. McGill Bldg., Washington, D. C. Inventor's handbook sent upon request.

PATENTS. Booklet free. Highest references. Best results. Send drawing or model for examination and opinion. Watson E. Coleman, Patent Lawyer, 644 G Street, Washington, D. C.

PATENTS—Send for form "Evidence on Conception" to be signed and witnessed. Form fee schedule, information, free. Lancaster and Allwine, 262 Ouray Bldg., Washington, D. C.

BUSINESS OPPORTUNITIES

Sales and Manufacturing Co-operation Desired

Experienced mechanical designing engineer and practical mechanic desires co-operation of sales organization or engineering and iron foundry for the exploitation of patents in the hotel and kitchen equipment line; fruit and vegetable paring machine, silver burnishing machine and small refrigerator, all electric driven. BO-737, American Machinist, Real Estate Trust Bldg., Phila., Pa.

FOR SALE

Patents Covering Oscillating Disc Valve

For Sale. This valve has been in successful use for over three years. It is suitable for use in such articles as automobile windshield cleaners and other devices requiring a forward and back motion. FS-728, Am. Mach., 10th Ave. at 36th St., New York.

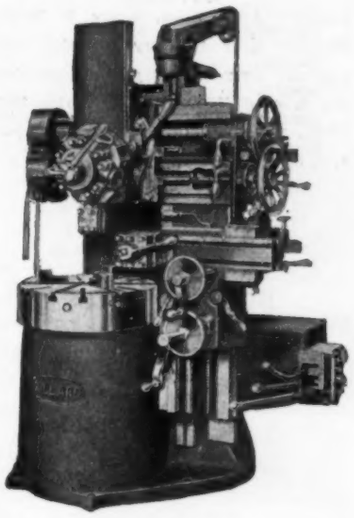
PATENTS

Send sketch or model today for examination and report. *Record of Invention* blank on which to disclose your invention and NEW *guide book, "How to Obtain a Patent,"* sent free. Promptness assured. Highest references. WRITE TODAY. CLARENCE A. O'BRIEN, *Registered Patent Lawyer*, 120-B, Security Savings & Com'l Bank Bldg., directly across street from Patent Office, Washington, D. C.

(Additional Miscellaneous Ads on p. 100)

Bullard Vertical Turret Lathes

A few choice 24-in. BULLARD NEW ERA TYPE VERTICAL TURRET LATHES in our warehouse that can be inspected under belt if desired. These machines have late serial numbers and are offered in line with the rest of our BARGAIN SURPLUS TOOLS at a saving of **$1700.00 each.**



Our Guarantee:

Your money back if you return a machine within thirty days, freight prepaid. No excuses necessary.

WE HAVE HUNDREDS OF NEW TOOLS AT 2ND-HAND PRICES

LATHES

5—26-in. LeBlond Crankshaft.
1—10-12-in.x5-ft. Pratt & Whitney.
1—14-in.x6-ft. Pratt & Whitney.
1—14-in.x 6-ft. Fay & Scott.
7—14-in.x 6-ft. Rockford.
1—14-16-in.x8-ft. Lodge & Shipley.
2—16-in.x 6-ft. Flather.
6—17-in.x 6-ft. LeBlond Pl. Turning.
4—18-in.x 8-ft. Walcott.
1—18-in.x 8-ft. Rockford.
1—18-20-in.x 8-ft. Amer., Gd. Hd.
1—18-20-in.x10-ft. Amer., Gd. Hd.
12—20-in.x 8-ft. LeBlond.
65—20-in.x 8-ft. American.
1—20-in.x10-ft. Walcott.
2—20-in.x16-ft. American.
1—20-in.-22-in.x10-ft. Amer., Gd. Hd
5—22-in.x12-ft. Mueller.
1—24-in.x10-ft. American.
16—24-in.x10-ft. Cisco.
1—24-in.x20-ft. Lodge & Shipley.
7—25-in.x10-ft. LeBlond.
16—25-in.x12-ft. LeBlond.
1—24-in.x15-ft. Chard.
4—26-in.x10-ft. Walcott.
15—26-in.x10-ft. Whitcomb-Blaisdell.
4—26-in.x13-ft. Wickes.
150—26-in.x 8-18-ft. Bridgeford.
2—30-in.x11-ft. American.
2—36-in.x12-ft. Wickes.
3—36-in.x14-ft. Johnson, Gd. Hd.
1—36-in.x20-ft. Putnam.
6—36-in.x30-ft. Pittsburgh, Gd. Hd.
4—36-in.x37-ft. N.-B.-P., Gd. Hd.
2—36-in.x42-ft. LeBlond, Gd. Hd.
3—40-in.x12-ft. Fifield.
1—36-in.x42-ft. Gisholt Gun Boring.
1—42-in.x16-ft. Bradford.
2—45-in.x24-ft. Pond.
1—33-51-in.x20-ft. LeBlond.
1—60-in.x18-ft. Johnson.
1—56-64-in.x18-ft. Johnston.

SHAPERS

3—16, 20, 24 and 28-in. Ohio.
3—16, 20-in. Cincinnati.

DRILL PRESSES

1—22¼-in. W. F. & J. Barnes.
2—25-in. W. F. & J. Barnes.
2—No. 310 Baker.
1—No. 24 Foote-Burt.
1—4-spindle Reed-Prentice.
1—4-spindle Allen.
10—6-spindle Allen.
1—No. 11 Natco.
6—No. M-4 Natco.
2—M-37 Natco Multiples.
1—No. 41 Natco.

RADIAL DRILLS

3—4-ft. Carlton, Sens.
1—3-ft. Prentice.
1—3-ft. Western Heavy.

VERTICAL BORING MILLS

6—24-in. Bullard, Vert. Turret Lathe.
8—24-in. Bullard, New Era.
1—48-in. Colburn.
1—54-in. Bullard, 2 Heads.
1—60-in. Bullard.

HORIZ. BORING MACHINES

3—No. 1 Barnes Horiz., 2 Heads.
1—Rockford Double Head.
1—4-in. Newark.
1—No. 1, 3¾-in. Bar Barrett.
1—Rochester Floor Borer.

GRINDERS

1—No. 6 Gardner Disc, B.B.
1—No. 16 Besley Disc.
1—No. 75 Heald, Internal.
1—No. 210 Heald, Ring.
1—22-in. P.&W., Vert.
1—15x96-in. Norton Surface.
1—No. 1 Landis, Univ.
1—No. 2 Fraser, Univ.
6— 6x32-in. Norton.
1—10x36-in. Landis.
12—10x36-in. Norton.
3—10x72-in. Norton.
5—12x36-in. Landis.
1—No. 3 Landis, Univ.
1—12x120-in. Landis.
1—14x 36-in. Norton.
1—14x 48-in. Queen City.
13—14x 50-in. Norton.
5—14x 72-in. Norton.
1—16x 48-in. Landis Crankshaft.
1—16x 72-in. Norton.

PLANERS

1—24x24-in.x 6-ft. American.
2—24x24-in.x 6-ft. Hamilton.
1—24x24-in.x 6-ft. Liberty, 2 Heads.
1—24x24-in.x12-ft. Whitcomb.
1—30x30-in.x 6-ft. Gray Spiral Gd.
1—30x30-in.x10-ft. Cincinnati.
1—30x30-in.x10-ft. W.&P.
1—30x30-in.x14-ft. Ohio, 2 hds., mot.
1—30x30-in.x14-ft. N.B.P., 2 hds.
1—36x30-in.x10-ft. Cincinnati, 3 hds.
1—36x30-in.x18-ft. W.-B.
1—36x30-in.x20-ft. W.-B.
1—36x36-in.x10-ft. Bickett.
1—36x36-in.x12-ft. Cincinnati, 4 hds.
3—42x42-in.x16-ft. Rockford.
1—72x56-in.x36-ft. Cincinnati.

MILLERS

45—No. 6 Whitney.
61—No. 3½ Fox.
1—No. 38-B Chicago.
20—12-in. Cincinnati.
1—No. 1-A Milwaukee.
1—No. 1 Kempsmith.
1—No. 1½ Rockford.
2—No. 1½-B Special Milwaukee.
3—No. 2 Rockford, S.P.D.
10—No. 2-B Brown & Sharpe, S.P.D.
7—No. 2-B Kearney & Trecker.
1—No. 2½ Rockford.
2—No. 3 Kempsmith.
1—No. 3 Kempsmith, Gd.
1—No. 3 Brown & Sharpe.
1—No. 3 Brown & Sharpe Univ.
1—No. 4 Brown & Sharpe.
2—No. 4-B Brown & Sharpe.
2—No. 4 LeBlond.
1—No. 13-B Brown & Sharpe.
3—No. 33 Kempsmith.
1—18-in. Cincinnati Auto.
2—Type A, 16 and 28-in. Briggs.
2—4-in. Pratt & Whitney Spline.

SLAB MILLERS

1—24x24-in.x 8-ft. Ing., 1 Vert. Hd.
7—24x24-in.x12-ft. Ingersoll Slab.
1—48-in.x10-ft. Newton.
1—No. 1½ Newton, Duplex.

GEAR CUTTERS AND HOBBERS

8—No. 1 Farwell.
1—No. 2½ Bilton Gear Cutter.
3—No. 1 Schuchardt & Schutte.
2—24-in. Gould & Eberhardt.
1—30-in. Flather.
7—No. 6 Fellows.
3—No. 3, 26-in. Brown & Sharpe.
1—36-in. Gould & Eberhardt.
1—No. 615 Fellows.

VERTICAL MILLERS

1—No. 1 Brown & Sharpe, Vert.
1—No. 2 Cincinnati, Vert.
3—No. 4-B Becker, Vert.
8—No. 3 Brown & Sharpe, Vert.
1—No. 3 Cincinnati, Vert.
3—Model 8, D. Becker, Vert.
1—No. AB Becker, Vert.
3—No. 5-B Becker, Vert.
7—No. 5-C Becker, Vert., New.
4—No. 6 Becker, Vert.

TURRET AND SCREW MACHINES

2—No. 0 9/16-in. Foster.
1—No. 2 1-in. Bardons & Oliver.
3—No. 2 1-in. Warner & Swasey.
1—No. 2 ⅝-in. Pratt & Whitney.
2—No. 2 1/16-in. Foster.
4—No. 2 1¼-in. W.&S. Fox.
5—No. 3 1⅛-in. Bardons & Oliver.
9—No. 3 1 5/16-in. Foster.
11—No. 4 1½-in. Wood.
1—No. 4 1½-in. Bardons & Oliver.
1—No. 6 2-in. Wood.
1—2x26-in. Pratt & Whitney.
1—2¼x26-in. Greenlee.
2—2½x26-in. P.&W. Gd. Hd.
3—3x36-in. Jones & Lamson.
1—No. 10 3-in. Bardons & Oliver.
1—3¼x36-in. Cincinnati, Acme.
1—No. 8 Warner & Swasey.
2—No. 5-A Potter & Johnston.
6—6-A Model 2, Potter & Johnston.
1—18-in. Libby.
2—21-in. Gisholt.
8—24-in. Gisholt Motor Drive.
5—24-in. Gisholt.
26—24-in. Davis.
33—24-in. Steinle.
1—34-in. Gisholt.

PRESSES

1—No. 1 Zeh & Hahnemann, Screw.
1—No. 57 Toledo Nosing.
2—No. D. G. G. 50 Ferracute, Gd.
3—No. 58 Toledo Nosing.
2—No. 87 Bliss Gd. Twin Drive.
1—No. 69 Stoll, Geared.

MISCELLANEOUS

1—Emery Wheel Stand.
1—No. 1 La Pointe Broach.
2—No. 3 La Pointe Broach.
1—No. 3 J. N. La Pointe Broach.
2—No. 3 J. N. La Pointe Double.
3—No. 4 La Pointe Broach.
70—Newton, Betts, Pratt & Whitney and Garvin Profilers.
18—Pilton Slotters.
3—Swind Bench Slotters.
1—Bausch, 5 spd. Nut Tapper.
2—No. 2 Garvin Auto. Vert. Tapper.
1—Oliver Filing Machine.
1—Geir Straightening Press.
1— 125-lb. United Hammer.
1—1500-lb. Niles-Bement-Pond Steam Hammer.
1—8-ft. Dreis & Krump Hand Brake.
1—No. 1 13-in. Niagara Hd. Beader.
1—No. 2 30x2-in. Niagara Roll.
1—Buffalo Hand Wiring Machine.

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HILL, CLARKE & CO. of CHICAGO

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REG U. S. PAT. OFF.

Telephone, Haymarket 7660

ReMANUFACTURED
-(ORIGINATED BY US)-
MACHINE TOOLS

SECOND-HAND MACHINE TOOLS

DRILLS

1-spindle Avey, Allen, Henry & Wright ball bearing.
2-spindle Avey & Henry & Wright ball bearing.
4-spindle Avey & Henry & Wright ball bearing.
No. 3, 4-spindle Avey ball bearing high speed drill, power feed to each spindle.
20-in., 25-in., 28-in., 30-in., 32-in., 36-in. uprights.
3, 4, 5, 6-ft. radials.
D-2 Colburn mfg. drill.
No. 513 Baker heavy mfg. type.
No. 12 Natco multiple spindle drill.
No. 13 Natco multiple spindle drill.
8-spindle Fox multiple spindle drill.
4-spindle Rockford mfg. drills 23 in.
3-spindle Barnes drills 20 in.
4-spindle Barnes drills 20 in.

BORING MILLS

No. 0 Giddings & Lewis, table type, horizontal 3-in. bar.
No. 1 Lucas, table type, horizontal 3-in. bar.
No. 2 Rockford horizontal boring and drilling machine.
Bement-Niles R & L, table type, horizontal 3⅞-in. bar.
34-in. Colburn vertical type, turret head.
24-in. and 36-in. Bullard, New Era type turret head.
62-in. Rogers, 2 heads on rail.
100-in. J. M. Poole, 2 heads on rail.

GRINDERS

No. 1 Brown & Sharpe universal.
12x36-in. Cincinnati universal.
3-in., 6-in., 10-in. swing x 18-ft., 32-in., 36-in., 72-in. long Norton plain.
14-ft. Pratt & Whitney vertical, surface type.
10-in. Garrigus, rotary surface type.
No. 1 Cincinnati cutter and tool.
No. 2 Walker cutter and tool.
No. 1 and 2 Norton cutter and tool.
No. 2 Oakley cutter and tool.
No. 60 Heald cylinder.
Taylor high speed water tool.
No. 2 Morse plain.
No. 14 Brown & Sharpe, plain.
10x24-in. Landis, plain.

SCREW MACHINES AND TURRET LATHES

No. 0 B & S automatic.
⅜-in., ½-in., ⅝-in., ⅞-in. Cleveland automatic plain. Model "B."
½-in., ⅝-in., ⅞-in. Cleveland automatic turret, Model "A."
4½-in. Gridley automatic, arranged for motor drive, with motor.
1-in., 1½-in., 2¼-in. Cincinnati-Acme with wire feed.
⅝-in., 1-in., 1½-in. Pratt & Whitney, with wire feed.
No. 2 B & S with wire feed.
2¼-in. and 3¼-in. Jones & Lamson, flat turret type, with both bar and chucking equipment.
2¼-in. and 3¼-in. Cincinnati-Acme ditto.
16-in. Warner & Swasey, Fox turret type with chasing bar.
16-in. Cincinnati-Acme, Fox turret type with chasing bar.
2-spindle Jones & Lamson flat turret lathe, turret type, with chucking equipment.
No. 2-A Warner & Swasey turret machine.
24-in. Steinle heavy mfg. turret lathe.

LATHES

9-in.x20-in. Porter Cable mfg. type.
14-in.x 6-ft. Lodge & Shipley, C.R., P.C.F., Q.C. cone head.
14-in.x 6-ft. LeBlond C.R., P.C.F., Q.C.
16-in.x 8-ft. LeBlond C.R., P.C.F., Q.C.
16-in.x 6-ft. Champion C.R., P.C.F., Q.C.
18-in.x 8-ft. Prentice Bros. C.R., P.C.F., Q.C., geared head.
20-in.x12-ft. American C.R., P.C.F., Q.C., geared head.
20-in.x 8-ft. American C.R., P.C.F., Q.C., cone head.
20-in.x10-ft. Lodge & Shipley C.R., P.C.F., Q.C., cone head.
24-in.x22-ft. Lodge & Shipley C.R., P.C.F., Q.C., cone head.
25-in.x10-ft. LeBlond C.R., P.C.F., Q.C., cone head.
24-in.x12-ft. LeBlond C.R., P.C.F., Q.C., cone head.
32-in.x14-ft. Hamilton C.R., P.C.F., Q.C., cone head, triple geared.
14-28-in.x8-ft. Fay & Scott gap lathe, cone head.
18-36-in.x8-ft. Fay & Scott gap lathe, cone head.
24-46-in.x10-ft. Fay & Scott gap lathe, cone head.
2-32-in.x8-ft. LeBlond gap lathe, cone head.

SHAPERS AND PLANERS

12-in. Smith & Mills crank shaper.
14-in. Pratt & Whitney crank shaper
15-in. Kelly crank shaper.
16-in. Gould & Eberhardt crank shaper, back geared.
20-in. Gould & Eberhardt crank shaper, back geared.
24-in. Gould & Eberhardt crank shaper, back geared.
26-in. Smith & Mills crank shaper, back geared.
15-in., 20-in. Hendey friction driven shaper.
24x24-in.x 6-ft. Flather planer, 1 head.
36x36-in.x12-ft. Pond planer, 2 heads.
50x40-in.x14-ft. Pond planer, 2 heads.
66x54-in.x12-ft. Pond planer, 2 heads.
66x60-in.x30-ft. Bement planer, 3 heads.
72x72-in.x20-ft. Gleason planer, 3 heads.

MILLERS

No. 0 and ½-in. Van Norman duplex millers.
No. 2, 3, 4 Cincinnati plain.
No. 2 and 3 Cincinnati universal.
No. 2 Hendey universal.
No. 2-A Brown & Sharpe universal.
No. 2, 3, 4 Cincinnati vertical.
No. 2-C Becker-Brainerd vertical.
No. 4½x12 Pratt & Whitney, thread type.
34-in.x10-ft. Ingersoll, slab type.

HENRY PRENTISS & CO., 149 BROADWAY, NEW YORK

BOSTON BUFFALO HARTFORD SYRACUSE ROCHESTER

Machinery and Equipment

Planers

36x36-in.x18-ft. Gray, 2 heads.
36x36-in.x12-ft. Pond, 2 heads.
36x36-in.x10-ft. Pond, 2 heads.
32x32-in.x 8-ft. Pond, 2 heads.
30x30-in.x 8-ft. Flather, 2 heads.
24x24-in.x 4-ft. Wheeler, 1 head.
24x24-in.x 6-ft. Cincinnati, 2 heads.
24x24-in.x 8-ft. Pratt & Whitney, 1 head.
24x24-in.x10-ft. Powell, 1 head.
24x24-in.x12-ft. Pratt & Whitney, 1 head; and four others 16 to 22 in., from 4 to 6 ft. platen.

Grinders

2—No. 2 Cincinnati Universal.
No. 2 Brown & Sharpe Surface.
2—No. 2 Brown & Sharpe Plain.
Pratt & Whitney Surface.
No. 160 Heald Surface.
Norton Universal Tool Room.
No. 4 Besley Disc.
20—Modern, Brown & Sharpe, Norton, Pratt & Whitney, Diamond & Washburn.

Millers

2—No. 2A Hendey Universal, with dividing head, vise, chuck.
2—No. 2 Milwaukee Plain, with dividing head, vise, chuck.
No. 3 Milwaukee Universal, with dividing head vise.
No. 3 Cincinnati, Plain, with dividing head, vise, chuck.
No. 2 Cincinnati Plain, with dividing head, vise, chuck.
No. 4 and No. 6 Becker Vertical.
1—No. 5 Brown & Sharpe vertical.
Also 15 more Hendey, Brown & Sharpe and Chicago, Plain, Universal and Hand.

Drills

20-in. Baker Heavy Duty.
24-in. Baker "P" Heavy Duty.
20, 22, 24, 25, 26, 28, 30, 36 and 42-in. plain and back geared, stationary and sliding heads—Makers: Snyder, Prentice, Niles, Aurora, Hamilton.
4 to 20-spindle Multiple—Makers: Western, Pratt & Whitney, Foote-Burt & Bausch.

Keyseaters

No. 0 Baker, with countershaft.
No. 1 Baker, with countershaft.
No. 2 Morton, with countershaft.

Boring Mill (Horizontal)

Rockford, Betts, Beaman & Smith and Niles-Bement-Pond.

Shapers

New No. 61 Fellows Gear Shaper.
2—36-in. Fellows Gear Shaper.
24-in. Fellows Gear Shaper.
9-in. Pratt & Whitney, with vise.
12-in. Pratt & Whitney, with vise.
15-in. Hendey, friction, with vise.
5—14-in. Pratt & Whitney, with vise.
2—16-in. Pratt & Whitney, with vise.
2—16-in. Ohio, with vise.
16-in. Smith & Mills, with vise.
20-in. Smith & Mills, with vise.
3—Fitchburg and Pratt & Whitney Traveling Hd.

Presses
(Power, Hydraulic and Arbor)

No. 20 Bliss Inclinable Press.
3—Farrel, 6-in. stroke Stamping Press.
Screw Straightening Press.
Nos. 1 to 3½ Greenerd Arbor Presses.
10—18 to 225-ton Watson-Stillman Vertical, Hydraulic Presses.

Radial Drills

6-ft. Pond, plain.
30-in. Bickford, plain.

Slotters

Betts, Pratt & Whitney and Bement Miles, from 6 to 30 in.

Screw Machines and Turret Lathes

⅜ to 3-in. Warner & Swasey, Pratt & Whitney, Bardons & Oliver, Jones & Lamson, Potter & Johnson and Gisholts.

Lathes

14 to 36-in. swing, with beds from 4 to 60 ft. long, many different types of the following makes: American, LeBlond, Hendey, Schumacker, Reed, Lodge & Shipley, Pratt & Whitney, McCabe, Niles, Johnson, Fitchburg, Blaisdell, Bradford, Flather, Putnam, Bullard and New Haven.

Gear Cutters

No. 4-48-in. Brown & Sharpe Gear Cutter.
24-in. Brown & Sharpe Spur and Bevel Gr. Cutter.

Motors

30—Direct Current, ½, ¾, 1, 2, 3, 5, 6, 7½, 10, 15, 20, 35, 50, 55, 75, and 80 hp., General Electric, Robbins & Meyer, Sprague, Wagner, Crocker-Wheeler, Allis-Chalmers, Westinghouse and Eddy. Also Generators of the above manufacture.

Miscellaneous

Broaching Machine, Bolt Threaders, Cold Saw, Hack Saw, Profilers, Cutting-Off Machines, Wood Planers, Jig Saw Table, Sander and a large quantity of small tools and equipment, Pulleys, Shafting and Hangers.

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36-in.x33-ft. Niles-Bement-Pond, H.D., M.D.
36-in.x27-ft. Niles-Bement-Pond, H.D., M.D.
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3-in. Eaton, Cole & Burnham.
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1—NEW 15-18-in. Dill slotter; mot. dr

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1—PRATT & WHITNEY No. 11.
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2—TOLEDO No. 57-S, 4½-in. stroke.
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1—BLISS-STILES type, No. 3.
1—BLISS No. 74½ punch.

MISCELLANEOUS

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1—ACME bolt cutter, 2 spindle, 1 in.
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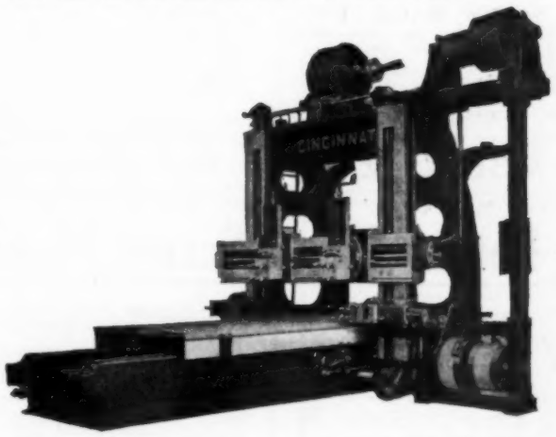

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24-in. Snyder Upright Drill Press, B.G., P.F.
26-in. Ryerson Upright Drill Press gear box drive, B.G., P.F.
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6x18-in. Landis Pl. Cyl. Grinder, self-contained.
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16-in.x 6-ft. Pratt & Whitney Q.C. Lathe.
18-in.x10-ft. Greaves & Klusman Q.C. Lathe.
22-in.x10-ft. Hamilton Semi-quick Change Lathe.
24-in.x12-ft. Lodge & Shipley Q.C. Lathe.
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22-in. Libby Turret Lathe single pulley drive, 4¼-in. hole.
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Shear, 10-ft. Niag. Ditto, 3/16-in. cap.
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Shear, Rotary, 36-in. Thrt., Quick Work, 3/16-in. cap, with motor.
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Turret Lathe, 26-in. Libby, 4½-in. hole in spindle.

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No. 3 Brown & Sharpe Plain Milling Machine, late type, $725.
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2—No. 3 Barnes Horizontal Drilling Machines, No. 3 spindles.
No. 3 Kempsmith Universal Milling Machines.
4¼-in. Gridley Single Spindle Automatic Screw Machine.
54x55-in.x14-ft. Pond Planer, three heads, arranged for four.
10-in. Stockbridge Motor Driven Shaper.

The O'Brien Machinery Co.

113 N. Third Street, Philadelphia, Pa.
Long Distance Telephone: Market 0727
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TOOLS FOR IMMEDIATE SHIPMENT

1—112-in. Pond Radial, motor drive.
1—4¼-in. Gridley Single Spindle Automatic.
1—1½-in. Dreses Geared Friction Head Screw Machine.
2—Special Horiz. Mills, 9-in. bar, Espen-Lucas, similar to Barret.
1—No. 31 Lucas Horizontal, 7-ft. bed, motor driven.
1—8-ft. Bickford Vertical Boring Mill, two heads with motor.
1—12-spindle Bausch Drill, Type 24-C.
1—5-ft. Bickford Plain Radial, Tapping Attachment.
1—6-ft. Western Triple Geared Heavy Type Plain, Tapping Attachment
1—14-in.x6-ft. Springfield Tool Room Lathe.
2—16-in.x8-ft. Springfield Tool Room Lathes, with Taper Attachment.
1—18-in.x8-ft. Springfield Tool Room Lathe.
2—26-in.x22-ft. Boye-Emmes, with Motor, Taper Attachment.
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1—New—36-in.x34-ft. Bridgeford Extra Heavy Geared Head
1—36-in.x18-ft. Bridgeford, Geared Head, M.D.
1—36-in.x16-ft. Niles-Bement-Pond, motor drive.
1—42-in. Niles-Bement-Pond Car Wheel Lathe.
1—48-in.x24-ft. Lodge & Shipley Lathe, Triple Geared.
1—48-in.x15-ft. Niles-Bement-Pond Screw Cutting Lathe.
1—72-in.x56-ft. Niles-Bement-Pond Forge Lathe.
1—92-in.x20-ft. Fitchburg Lathe.
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2—No. 3 Standard Universal Geared Head Cincinnati Miller.
1—No. 2 Geared Spindle Hendey Univ. Miller, Univ. Equipment.
1—24-in. Stockbridge Shaper, back geared.
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1—Ramson Motor Driven Emery Grinder, 16-in. Wheel, with motor.
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1—No. 3 Brown-Sharpe Universal Grinder.
1—12x36-in. Modern Grinder, self-contained.
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1—20-in. Cincinnati Shaper.
1—No. 2 Baker Keyseater.

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30—1-2-3-4 and 6-spdle., High Speed Drills.
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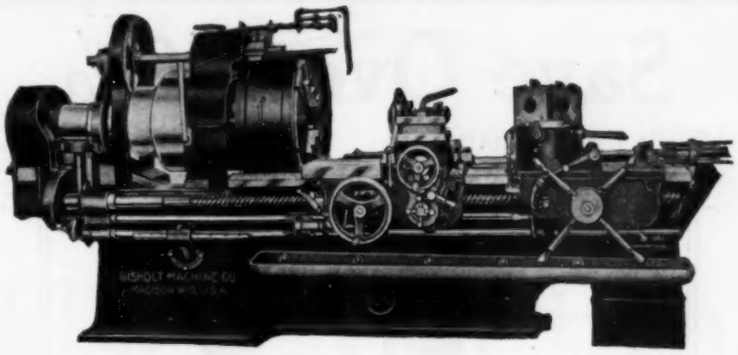

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Three 28-in.—3½-in. Spindle Bore
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These lathes have been entirely rebuilt in our own shop with same jigs and fixtures used when first built. We guarantee them to be as accurate as new machines. Also

One 60-in. Rebuilt Vertical Boring Mill
One 36-in. Used Vertical Boring Mill
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Gisholt Machine Company

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NO. 2A FOX UNIVERSAL

MILLERS—Single Pulley Drive

LONGITUDINAL FEED	26-in.
CROSS FEED	8-in.
VERTICAL ADJUST	13-in.
SIZE OF TABLE	8½x27-in.

PRICE $490.00 EACH

Complete with regular equipment. Some have vertical milling attach. $35 extra

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Exceptional bargains in new and used machinery, such as Brown & Sharpe automatics and wire feed screw machines, lathes, shapers, grinders, milling machines, etc.

Send for complete list, all of which we own and can assure you our quality and quantity of stock will surprise you, as will the low prices.

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Plainville, Conn., U. S. A.

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Used Machinery

FOR SALE

Powell Planer 48-in.x12-in.x36-in. high. Countershaft drive, Detroit Single Wheel Centerless Grinder, 4-in. face wheel. Horizontal Boring Mill. American Lathe, 30-in.x5-ft. with 30-in. face plate. Cleveland 2-in. Model "A" Automatic Screw Machine with complete equipment. Single Head Bullard Vertical Boring Mill, 14-in.x30-in. Bullard Lathe, No. 6 Whitney Hand Miller, Little Giant 1½-in. Bolt Cutter.

These machines all in good condition, can be seen set up in factory.

HOE CORPORATION
Poughkeepsie, N. Y.

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Lathes
12 in. to 63 in. and most intermediate sizes.

Planers
20x20 in. to 10x10 ft. and 11 intermediate sizes.

Millers and Gear Cutters
Plain and Vertical Millers.
Bevel and Spur Gear Cutters.

Drilling Machines
Vertical, Radial and Multiple Spindle.

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Vertical and Horizontal, most of them our own make.

See Complete List First Issue of Each Month, Or Send for List.

BARGAINS IN Gear Cutters—Lathes —Screw Machine

We have for sale at attractive price concessions the following machinery, which can be seen at any time at our factory. They are all in first-class condition; some have had very little use:

1—½" Radial Automatic Screw Machine.
2—24x8" Newark Automatic Gear Cutters.
3—2¼x24" Jones & Lamson Flat Turret Lathes.
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Perfect condition, can be seen in operation. Immediate delivery. Reasonable.

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44 in. MAXI MILL
$5250.00

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Also the following machines

NEW

36-in. Niles Vertical Turret Lathes (2)
No. 6 ACA Bridgeport Motor Grinders.
Pneumatic Chipping Vises.
Hannafin Milling Machine Vises, air.
Thor, Size E, Chipping Hammers.
No. 26 Higley, cold cut Power Saw, 36 in.
Grotnes Trimming Lathe.
Y & T, 3 and 4-ton Army-Navy Chain Blocks.
Smokestacks (2), 48 in.x125 ft., steel.

USED

Acme, Class A, Bolt Cutter, up to 3½ in.
Cleveland, Model A, Turret Lathe.
New Haven 54-in. Stub Lathes.
No. 4 Williams-White Bulldozer, 54 in.
No. 51 Conedy Otta wall-type Drill.
30-in. Oliver Band Saw.

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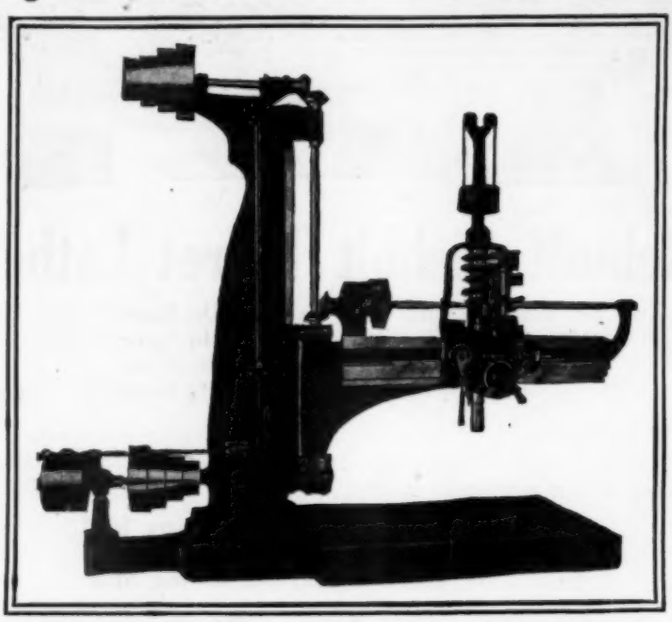

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25 Mechanic St. **Newark, N. J.**

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(GEARED)

LONGITUDINAL FEED, - 18-in.
TRANSVERSE FEED, - 6-in.
VERTICAL ADJUST, - 13-in.
SIZE OF TABLE, - 6-in. x 30-in.

PRICE $275.00 EACH

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No. 124 Max Ams Inclinable.
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No. 54 Niagara Straight Sided, geared.
No. 1 Standard Broaching and Drawing, 20 tons, 7-in. stroke.
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No. 15 Greenerd Arbor Press.
Large Size Hand Screw Press.

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24-in.x8-ft. Ingersoll Miller, fixed rail type, 3 heads.
No. 1M Potter & Johnston Automatic, two double tables.
No. 5C Becker Vertical, with rotary.
No. 25 Bilton B. G. Plain.
No. 6 Whitney Hand.
U. S. Hand, P. F. Vertical.
No. ½ Van Norman.

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No. 1 ½x18 Pratt & Whitney Hand.
No. 2 ½ Garvin Hand G. F. H. 1 7/16 capacity.
2¼x24 Jones & Lamson, for chucking only.
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Bement Miles Planer, 52x60-in.x10-ft., three heads, excellent condition; very cheap.
12-in. Bement Miles Slotter.
No. 1 Cleveland Horizontal Boring Milling and Drilling Machine.
No. 3A Universal Horizontal Boring and Milling Machine.
42-in. Niles Bement Pond Vertical Boring Mill.
No. 3 Wilmarth & Morman Automatic Surface Grinder.
3-ft. Prentice Plain Radial Drill.
No. 3 Brown & Sharpe Automatic Gear Cutter.
No. 13 Brown & Sharpe Automatic Gear Cutter.
72-in. Gould & Eberhardt Rack Cutter.
42-in.x20-ft. Lodge & Shipley Geared Head Engine Lathe.
Rockford Shaft Straightener, 3-in. capacity, 10-ft. bed.

BROWNELL MACHINERY CO.
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With sliding head and tapping attachment.
$550
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42-in. Bullard Boring Mill.
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No. 27 Stewart Oren Furnace (oil).
Cleveland Profile Grinder.
No. 6-A Bryant Chucking Grinding.
4-in. Pratt and Whitney Spline Miller.
S. and K. Automatic Wire Weaving Machine.
Ask For Complete List.
McMullen Machinery Co., Grand Rapids, Mich.

320

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Every machine doing valiant duty in your plant today is a used machine. The only difference between that machine and any machine in the following list is the fact that you know how your own machine has been used. This difference is so slight you can ill afford to neglect an inspection of this War Department offering.

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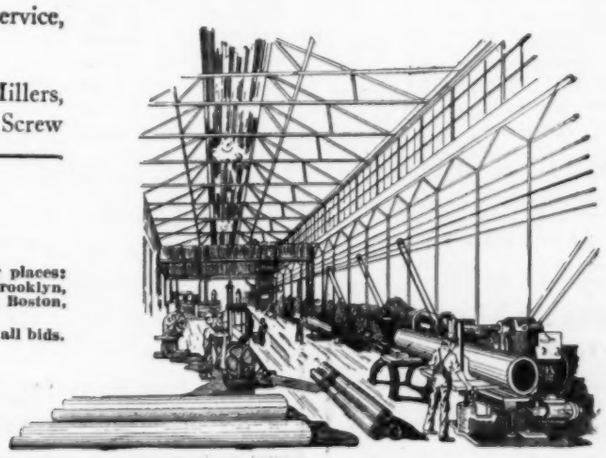
1 Rockford No. 13 Drill Press; 3 Millers, Pratt & Whitney, Brown & Sharpe; 7 Screw Machines, Cleveland, Warner & Swasey; 1 Drilling Machine, Pratt & Whitney, 2-spindle; 2 La Pointe Broaching Machines; 11 Lathes, Hendey, Pratt & Whitney, Gridley, Southworth, Steinle, Lo-Swing, Acme, Warner & Swasey, Davis; 14 Grinders, Union, Modern, Landis, Bryant, Challenger; 1 Union Cutter No. 2; 4 Drill Presses, Garvin 4-spindle; 1 Automatic Miller; 1 Upright Drill, 18-in.; 2 Drop Hammers, Chambersburg; 3 Furnaces, Economy, lead pot; 1 Furnace, Rockwell; 2 Electric Furnaces; 1 Electric Oven; 9 Motors, Westinghouse, Bernard, 9 to 20 hp.; 1 Boiler, portable; 1 Gas Engine, hoisting, Gould, Shapley & Muir with 6 hp. motor; 1 Troy Engine, steam, vertical.



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(Continued from page 99)

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Machine tools suitable for tool room or experimental work. Will sell or lease building. Must sell on account of health.
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Complete Set of Dies

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4-Spindle Automatic Machine made by the National Acme Automatic Machine Co. for rod work only; full set of collets for both hex. and round work; also a set of holders for tools of 1¼-in. shank, and complete with countershaft. A good machine for anyone who can keep it busy on rod work.

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For Sale By

CARBON STEEL COMPANY

Ft. 32nd St. & A. V. R. R., Pittsburgh, Pa.

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Bending machine, Crosgrove sgl. geared, 6 ft. 8 in. width of head, 54-in. flywheels	$250
Cutting-off machine, Niles Tool Works, 10-in. capacity, double head, 12-ft. bed, 2 carriages, 4-step cone pulley and countershaft	300
Cutting-off machine, Hurlbut-Rogers, 3-in. capacity	100
Cutting-off machine, Hurlbut-Rogers, 6-in. capacity	200
Cutting-off machine, Niles Tool Works, 10-in. capacity, 12-ft. bed, 2 carriages, 4-step cone pulley	300
Cutting-off machine, Fawcus, complete with 10-hp. starter, 12-in. capacity, 12-ft. bed	350
Drill, Pond Machine Co. 6-ft. radial, belt drive	1000
Drill, Superior Machine Co. 24-in., back geared	100
Drill, Aurora Tool Works 21-in. upright, stationary head, back geared	100
Grinders, Miami Valley Machine universal, 4x25½-in. table	100
Grinders, Espen Lucas 1⅝x13-in. spindle	75
Grinders, Oesterlein, 3x24-in. table	50
Lathes, Israel H. Johnson 30x18-in., back geared, 5-step cone drive, (3)	350
Lathe, Schumacher, Boye & Emmes 18 in. x 8 ft., d. b. grd., 3-step cone & c. s.	250
Lathe, 36-in.x27-ft. roll lathe, 60-in. face plate	500
Lathe, P. P. Silk Machine Tool Co. 16x8 ft., s. b. grd., 5-step cone drive	150
Lathe, LeBlond 30 in. x 15 ft.	150
Miller, Philadelphia Machine Tool Co., d. s. 6x12 in., special for test pull plates	
Miller, Brown & Sharpe No. 3 back geared universal, 3-step cone drive	500
Pipe machine, Curtis & Curtis, 6-in. capacity	50
Planer, Gleason 72x60-in.x10-ft. 6-in., table 60 in. wide	700
Planer, 24-in. buzz planer, 6-ft. table	100
Shears, side cutting, Lewis Foundry, s. grd., 18-in. blade	200
Shear, plate, R. D. Wood 2x128-in. hyd., 26-in. capacity	
Shears, Mackintosh steam driven, 30½-in. throat, 4-in. str., 24-in. shear blade, (2) Each	500
Shear, Mackintosh s. grd., 22-in. throat, 16-in. blade, 2-in. stroke	

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1—30-in. Pond Engine Lathe, 26-ft. bed, arranged for either belt or motor drive.
1—No. 3 Cincinnati belt-driven Milling Machine.
1—18-in. J. Steptoe belt-driven Shaper.
1—Sellers Drill Grinder, 8-in. wheel, belt driven.
1—12-in. standard type Emery Wheel, belt driven.
1—Barrett Facing Machine, belt driven.
1—Barnes 14-in., belt-driven Drill.
1—18-in. Morton Key-waying Machine, belt driven.
1—Belt-driven Power Hack Saw.
1—12-spindle Bausch Standard Multiple Drill, vertical, belt driven.
1—No. 30 Bausch Horizontal Multiple Drill, belt driven.
1—8-ft. Niles Engine Lathe, arranged for motor drive.
1—6-ft. Niles Radial Drill.

The M. W. Kellogg Company
Jersey City, N. J.

49—Ball Bearing Motors, ¾ hp., 1 ph., 60 cy., 1750 r.p.m. $48.00
20—Motor-Driven Grinders, ¼ hp., with cord, 220 or 110 v. Each $24.95
1—24-in. x 12-ft. bed Reed Lathe, Quick Change. $1150.00
1—B. & S. No. 1 Universal Grinder. $525.00

A. C. BISGOOD
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Real Bargains

One 4-ft. Heavy Duty MUELLER radial drill, gear drive, good as new.
One rebuilt 3½-ft. MUELLER radial drill, with 4-ft. arm and base, cone drive.
One Rebuilt 2½-ft. MUELLER radial drill, cone drive.
These machines are in excellent shape, practically new.

Write or wire us for prices

The Mueller Machine Tool Co.
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FOR QUICK SALE

No. 1 Acme all steel bolt heading upsetting machine, first class condition. Price $2,250.
No. 3 Brown & Sharpe Vertical Spindle Milling Machine, New. Price, $1,575.

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Columbia, Pa.

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Late style, cone driven
A-1 Condition
Low Price

MILES MACHINERY CO.,
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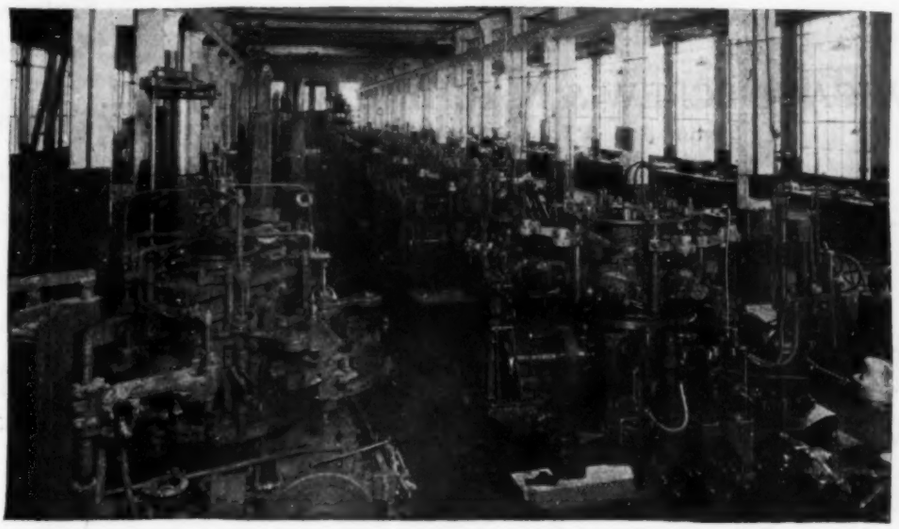

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Jigs, Fixtures, Dies, Gauges and Special Machines

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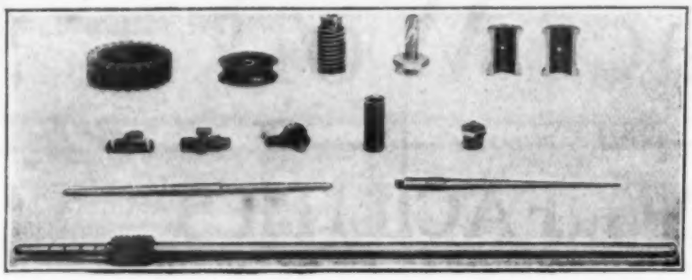

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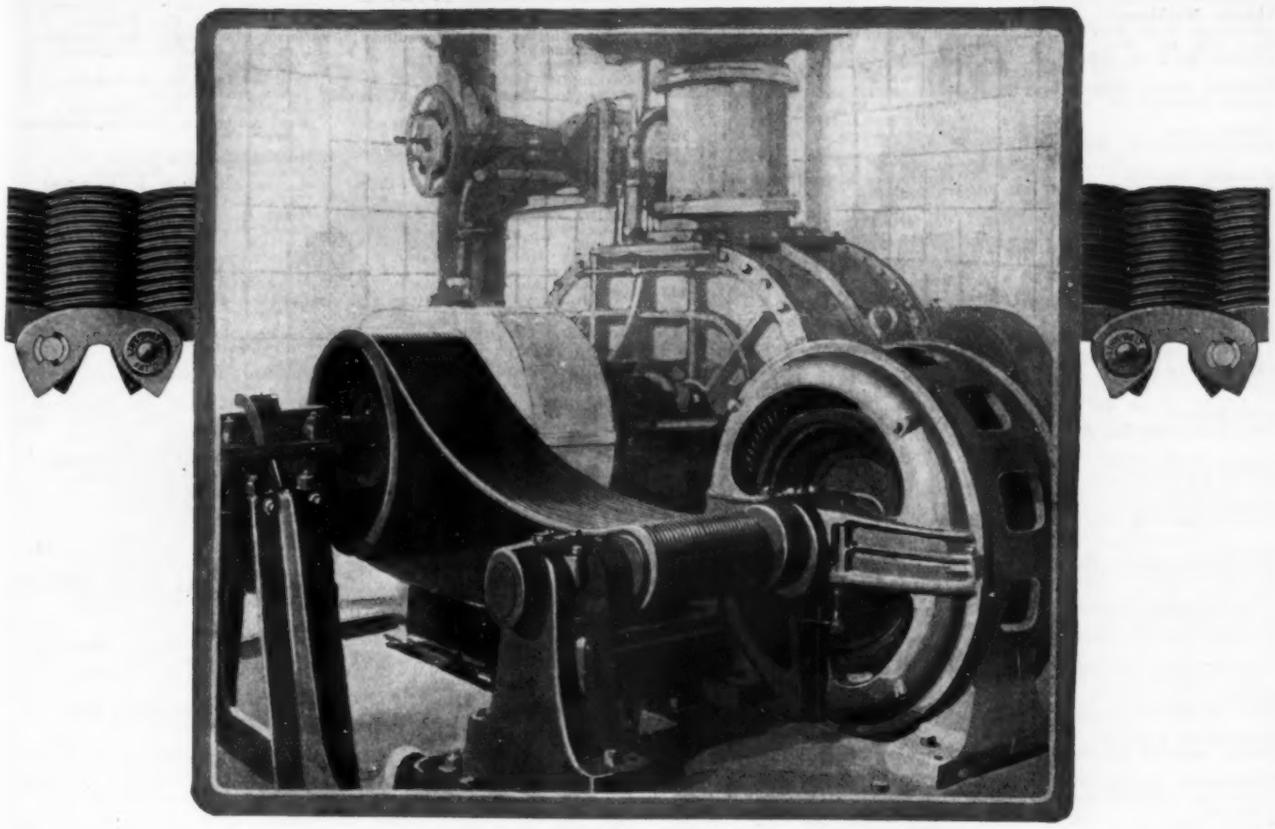

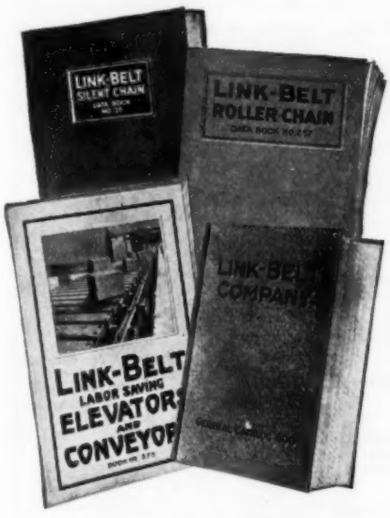

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Johnson Mach. Co., Carlyle, Manchester
Nicholson Co., W. H., Wilkes-Barre
Standard Pressed Steel Co., Phila.

Cranes, Electric (See Hoists and Cranes, Electric)

Cranes, Hand (See Hoists)
Link-Belt Co., Chicago-Phila.

Cranes, Traveling
Canton Fdry. & Mch. Co., Canton
Chisholm-Moore Mfg. Co., Cleveland
Link-Belt Co., Chicago-Phila.
Niles-Bement-Pond Co., N. Y.
Northern Eng. Wks., Detroit
Shepard Elec. C. & H. Co., Montour Falls
Whiting Corp., Harvey

Crank Pin Turning Machines
Reed-Prentice Co., Worcester
Underwood Corp., H. B., Phila.

Crucibles
Dixon Crucible Co., Jos., Jersey City

Cut-outs, Elect.
General Elec. Co., Schenectady

Cutters, Gear
Brown & Sharpe Mfg., Co., Providence
National Tool Co., Cleveland
Natio inalTwist D. & T. Co., Detroit
Union Twist Drill Co., Athol

Cutters, Milling
Cowles Tool Co., Cleveland
Geometric Tool Co., New Haven
Ingersoll Mill. Mch. Co., Rockford
Haynes Stellite Co., N. Y. C.
Lovejoy Tool Co., Inc., Springfield, Vt.
Morse Twist Drill & Mch. Co., New Bedford.
National Tool Co., Cleveland
National Twist D. & T. Co., Detroit
Pratt & Whitney Co., Hartford
Reed-Prentice Co., Worcester
Sommer & Adams Co., Cleveland
Tabor Mfg. Co., Philadelphia
Union Twist Drill Co., Athol
Whitney Mfg. Co., Hartford

Cutters, Thread
Rivett Lathe & Grinder Corp., Boston

Cutting-Off Machines
Armstrong-Blum Mfg. Co., Chicago.
Armstrong Bros. Tool Co., Chicago.
Brown & Sharpe Mfg. Co., Providence
Earle Gear & Mach. Co., Phila.
Etna Machine Co., Toledo
Garvin Mach. Co., N. Y.
Gorton Mach. Co., Geo., Racine
Vandyck Churchill Co., N. Y.

Cutting-Off Machines, Pipe (See Pipe-Cutting and Threading Machines)

Cutting-Off Tools
Armstrong Bros. Tool Co., Chicago

Cutting Oil Filters (See Oil Filtering Systems)

Cutting, Oxyacetylene
Prest-O-Lite Co., Inc., N. Y. C.

Dealers, Machinery (See Searchlight Section)
Bisgood, A. C., Bridgeport
Botwinik Bros., New Haven
Broadway Mchy. Co., N. Y. C.
Brownell Mchy. Co., Dayton
Carbon Steel Co., Pittsburgh
Eastern Machy. Co., Cincinnati
Electric Welding Sup. & Sales Co., Boston
Easley Mach. Co., E. L., Chicago
Factory & Mill Sup. Co., Boston
Gisholt Mach. Co., Madison
Harris Bros. Co., Chicago
Hill, Clarke & Co., Chicago.
Hirsch, G. B., Bridgeport
Hoe Corp., Poughkeepsie
Hyman & Sons, Jos., Philadelphia
Ideal Mchy. Co., Plainsville
Kellogg Co., M. W., Jersey City
Lamberg & Co., A., N. Y.
Lucas & Son, Inc., J. L., Bridgeport
Machinery Dealers, Inc., New Haven
McMullen Mchy. Co., Grand Rapids
Marshall & Huschart Mchy. Co., Chicago
Miles Mchy. Co., Saginaw
Morey & Co., N. Y.
Mueller Mch. Tool Co., Cincinnati
Myers Mach. Tool Corp., Columbia, Pa.
New Jersey Machy. Exch., Newark
Niles-Bement-Pond, N. Y.
O'Brien Mchy. Co., Phila.
Osborne & Sexton Mchy. Co., Columbus
Prentiss & Co., Henry, N. Y.
Simmons Mach. Tool Corp., Albany
Smith Bearings Co., L. C., Chicago
Stokvis & Sons, R. S., N. Y.

Demagnetizers
Luma Elect. Equip. Co., Toledo
Walker Co., O. S., Worcester

Diamond Tools
Desmond-Stephan Mfg. Co., Urbana
Dickinson, Thomas L., N. Y.
Wheel Trueing Tool Co., Detroit

Die Making Machines
Anderson Die Mch. Co., Bridgeport
Haskins Co., R. G., Chicago
Keller Mech. Eng. Co., Brooklyn

Die Sets
Danly Mach. Spec., Inc.

Dies, Forging
Keller Mech. Eng. Co., Brooklyn
Steel Products Eng. Co., Springfield, O.

Dies, Self-opening Adjustable
Cons. Mach. Tool Corp., Rocheter
Eastern Mch. Screw Corp., New Haven
Geometric Tool Co., New Haven
Jones & Lamson Mach. Co., Springfield, Vt.
Landis Mch. Co., Waynesboro
Murchey Mchy. & Tool Co., Detroit
Victor Tool Co., Waynesboro

Dies, Sheet Metal and Sub-Press (See Tool Work)

Dies, Threading-Opening
Eastern Mch. Screw Corp., New Haven
Geometric Tool Co., New Haven
Jones & Lamson Mach. Co., Springfield, Vt.
Landis Mch. Co., Waynesboro
Murchey Mchy. & Tool Co., Detroit
National Acme Co., Cleveland
National Machinery Co., Tiffin.
Steel Products Eng. Co., Springfield, O.
Victor Tool Co., Waynesboro
Warner & Swasey Co., Cleveland

Dividing Heads
Knight Mchy. Co., W. B., St. Louis
U. S. Mch. Tool Co., Cincinnati

Dogs, Lathes & Milling Machines
Armstrong Bros. Tool Co., Chicago

Dressers, Grinding Wheel
Bay State Stamping Co., Worcester
Desmond-Stephan Mfg. Co., Urbana
Millers Falls Co., Millers Falls
Norton Co., Worcester

Drill Holders
Armstrong Bros. Tool Co., Chicago

Drill Rods
ancaster Steel Products Corp., Lancaster

Drill Speeders
Graham Mfg. Co., Providence

Drilling Machine Heads
Hoefer Mfg. Co., Freeport.
Langelier Mfg. Co., Cranston
Nelson-Blanck Mfg. Co., Detroit.
U. S. Drill Head Co., Cincinnati

Drilling Machines, Automatic
Baker Bros., Toledo
Langelier Mfg. Co., Cranston
Nat'l Automatic Tool Co., Richmond

Drilling Machines, Bench
Ames Co., B. C., Waltham
Barnes, John & W. F., Rockford
Clark Elec. Co., Jr., Jas., Louisville
Henry & Wright Mfg. Co., Hartford
Hoefer Mfg. Co., Freeport
Langelier Mfg. Co., Cranston
Millers Falls Co., Millers Falls
Sigourney Tool Co., Hartford
Silver Mfg. Co., Salem
Taylor & Fenn Co., Hartford.

Drilling Machines, Electric and Pneumatic
Black & Decker Mfg. Co., Baltimore
Chicago Pneumatic Tool Co., N. Y.
Clark Elec. Co., Jr., Jas., Louisville
Hisey-Wolf Mach. Co., Cincinnati
Neil & Smith Elec. T. Co., Cincinnati
Silver Mfg. Co., Salem
U. S. Elec. Tool Co., Cincinnati
Wisconsin Elect. Co., Racine

Drilling, Machines, Gang
Baker Bros., Toledo
Barnes Drill Co., Rockford
Cincinnati (O.) Bickford Tool Co.
Foote-Burt Co., Cleveland
Fosdick Mch. Tool Co., Cincinnati
Henry & Wright Mfg. Co., Hartford
Langelier Mfg. Co., Cranston
Moline Tool Co., Moline
Prest-O-Lite Co., N. Y.
Rockford (Ill.) Drilling Mach. Co.
Silver Mfg. Co., Salem
Taylor & Fenn Co., Hartford

Drilling Machines, Heavy Duty
Baker Bros., Toledo
Barnes Drill Co., Inc., Rockford
Cons. Mach. Tool Corp., Rochester
Foote-Burt Co., Cleveland
Fosdick Mch. Tool Co., Cincinnati
Hoefer Mfg. Co., Freeport
Minster Mch. Co., Minster
Ryerson & Son, Joseph T., Chicago

Drilling Machines, Horizontal (See Boring, Drilling and Milling Machines, Horizontal)

Drilling Machines, Multiple Spindle
Baker Bros., Toledo
Cons. Mach. Tool Corp., Rochester
Detroit Mach. Tool Co., Detroit
Foote-Burt Co., Cleveland
Fox Mach. Co., Jackson, Mich.
Langelier Mfg. Co., Cranston
National Acme Co., Cleveland
Nat'l Automatic Tool Co., Richmond
Rockford (Ill.) Drilling Mach. Co.
Sellers & Co., Wm., Philadelphia
Sigourney Tool Co., Hartford

Drilling Machines, Radial
American Tool Wks. Co., Cincinnati
Cincinnati (O.) Bickford Tool Co.
Dreses Mch. T. Co., Cincinnati
Fosdick Mach. Tool Co., Cincinnati
Henry & Wright Mfg. Co., Hartford
Morris Mch. Tool Co., Cincinnati
Muller Mch. Tool Co., Cincinnati
Niles-Bement-Pond Co., N. Y.
Reed-Prentice Co., Worcester
Ryerson & Son, Joseph T., Chicago
Sellers & Co., Wm., Philadelphia
Western Mch. T. Works, Holland

Drilling Machines, Sensitive
Henry & Wright Mfg. Co., Hartford
Langelier Mfg. Co., Cranston
Leland Gifford Co., Worcester
Sigourney Tool Co., Hartford
Taylor & Fenn Co., Hartford
U. S. Mch. Tool Co., Cincinnati
Wisconsin Elect. Co., Racine

Drilling Machines, Turret
Nat'l Automatic Tool Co., Richmond

Drilling Machines, Vertical
Aurora Tool Co., Aurora
Baker Bros., Toledo
Barnes, W. F. & John, Rockford
Barnes Drill Co., Inc., Rockford
Buffalo Forge Co., Buffalo
Cincinnati (O.) Bickford Tool Co.
Foote-Burt Co., Cleveland
Fosdick Mch. Tool Co., Cincinnati
Henry & Wright Mfg. Co., Hartford
Hoefer Mfg. Co., Freeport
Knight Mchy. Co., W. B., St. Louis
Langelier Mfg. Co., Cranston
Leland-Gifford Co., Worcester
Ryerson & Son, Jos. T., Chicago
Silver Mfg. Co., Salem
Taylor & Fenn Co., Hartford
U. S. Mch. Tool Co., Cincinnati

Drills, Center
Cogsdill Mfg. Co., Detroit
Gledhill Mfg. Co., Providence
Morse Twist D. & M. Co., New Bedford
National Twist D. & T. Co., Detroit
Union Twist Drill Co., Athol

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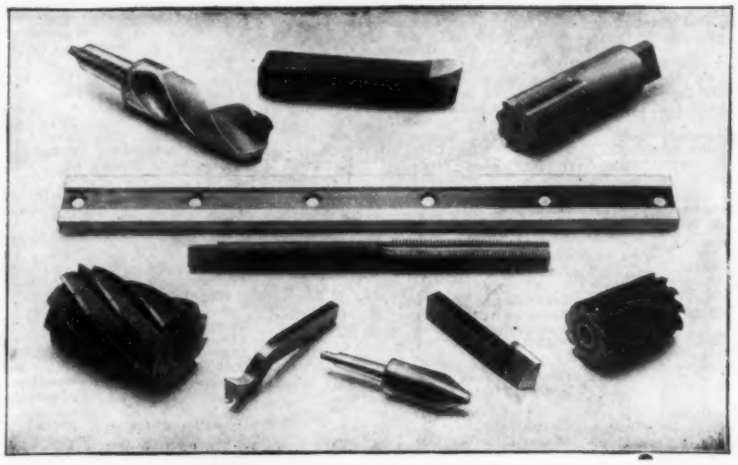

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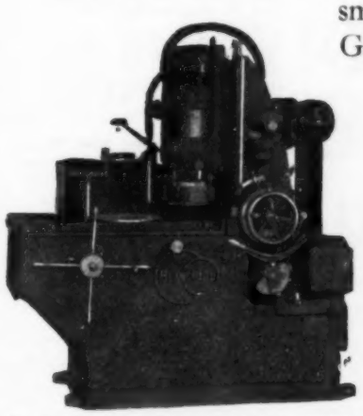

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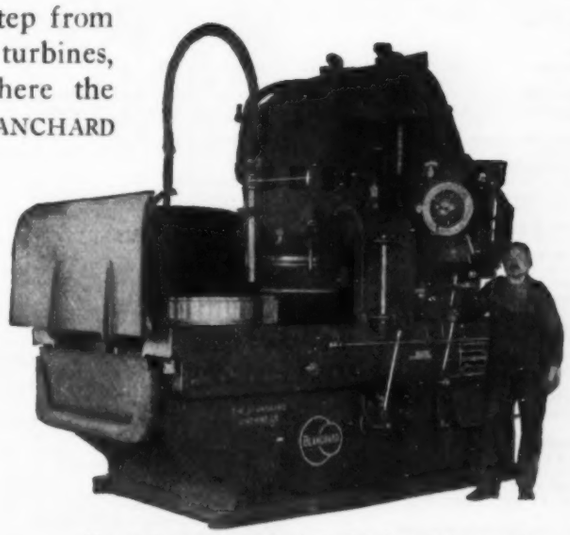

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Buckeye Twist Drill Co., Alliance
Morse Twist D. & M. Co., New Bedford
National Twist D. & T. Co., Detroit
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Keller Mech. Eng. Co., Brooklyn
Reed- Prentice Co., Worcester

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Watson-Stillman Co., N. Y.

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Westinghouse Elect. & Mfg. Co., E. Pittsburgh

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General Electric Co. Schenectady
Westinghouse Elect. & Mfg. Co., E. Pittsburgh

Fans, Ventilating
General Electric Co. Schenectady
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Files and Rasps
Delta File Works, Philadelphia

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Cochrane-Bly Co., Rochester
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Watson-Stillman Co., N. Y.

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Bradley & Son, C. C., Syracuse
National Mchy. Co., Tiffin

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Bearings Co. of America, Lancaster

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Adams Co., Dubuque

Foundry Supplies
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Chicago Flexible Shaft Co., Chicago

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American Gas Furnace Co., Elizabeth
Chicago Flexible Shaft Co., Chicago

Furnaces, Heat-Treating, Coal
American Industrial Furnace Corp., Boston

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American Industrial Furnace Corp., Boston
Brown & Sharpe Mfg. Co., Providence
Chicago Flexible Shaft Co., Chicago
Johnson Gas Appliance Co., Cedar Rapids
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American Gas Furnace Co., Elizabeth
Brown & Sharpe Mfg. Co., Providence
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Johnson Gas Appliance Co., Cedar Rapids
General Electric Co., Schenectady
Strong, Carlisle & Hammond Co., Cleveland

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General Elect. Co., Schenectady
Westinghouse Elec. & Mfg. Co., E. Pittsburgh

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Brown Eng. Co., Reading
Mfg. Equip. & Eng. Co., Framingham

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Federal Products Corp., Providence
Jones & Lamson Mach. Co., Springfield, Vt.

Gages, Dial
Ames Co., B. C., Waltham
Brown & Sharpe Mfg. Co., Providence
Federal Products Corp., Providence
Randall & Stickney, Waltham
Starrett Co., L. S., Athol

Gages, Plug & Ring
Bath & Co., John, Worcester
Brown & Sharpe Mfg. Co., Providence
Pratt & Whitney, Hartford

Gages, Recording
Bristol Co., Waterbury

Gages, Snap, Thread and Cylindrical
Bath & Co., John, Worcester
Brown & Sharpe Mfg. Co., Providence
Federal Products Corp., Providence
Pratt & Whitney Co., Hartford

Gages, Standard
Brown & Sharpe Mfg. Co., Providence
Federal Products Corp., Providence
Hartford Special Mchy. Co., Hartford

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Prest-O-Lite Co., Inc., N. Y. C.

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Graton & Knight Mfg. Co., Worcester

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Bilgram Mch. Wks., Philadelphia
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O.) Gear Cut. Mch. Co.
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Flather Co., Nashua
Garvin Mch. Co., N. Y.
Gleason Works, Rochester
Gould & Eberhardt, Newark
Newark Gear Cut. Mch. Co., Newark
Waltham Mch. Wks., Waltham
Whiton Mch. Co., D. E., New London

Gear Materials
Continental Fibre Co., Newark
General Elect. Co., Schenectady

Gear Tempering Machinery
Gleason Works, Rochester

Gear Testing Machinery
Adams Co., Dubuque
Brown & Sharpe Mfg. Co., Providence
Gisholt Mach. Co., Madison
Gleason Works, Rochester
Newark Gear Cut Mch. Co., Newark

Gears, Cast
Brown Co., A. & F., N. Y.
Brown & Sharpe Mfg. Co., Providence
Caldwell & Son Co., H. W., Chicago
Franklin Die Cast Corp., Syracuse
Grant Gear Works, Boston
Horsburgh & Scott Co., Cleveland
Jones Fdry. & Mch. Co., W. A. Chicago
Link-Belt Co., Chicago-Phila.
Philadelphia Gear Wks., Phila.

Gears, Cut
Adams Co., Dubuque
Atlantic Elevator Co., Philadelphia
Bilgram Mch. Wks., Philadelphia
Boston Gear Wks., Norfolk Downs
Brown Co., A. & F., N. Y.
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O.) Gear Co.
Connecticut Gears, Inc., Waterbury
Diefendorf Gear Corp., Syracuse
Earle Gear & Machine Co., Phila.
Fawcus Mch. Co., Pittsburgh
Fellows Gear Shaper Co., Springfield, Vt.
Flather Co., Nashua
Foote Bros. Gear & Mch. Co., Chicago
Garvin Mch. Co., N. Y.
General Elect. Co., Schenectady
Gleason Works, Rochester
Grant Gear Works, Boston
Horsburgh & Scott Co., Cleveland
James Mfg. Co., D. O., Chicago
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Link-Belt Co., Chicago-Phila.
Massachusetts Gear & T. Co., Woburn
Meacham Gear Corp., Syracuse
Meisel Press Mfg. Co., Boston
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Niles-Bement-Pond Co., N. Y.
Nuttal Co., R. D., Pittsburgh
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Athol Machine & Fdry. Co., Athol
Blount Co., J. G., Everett
Brown & Sharpe Mfg. Co., Providence
Clark Elec. Co., Jr., Jas., Louisville
Diamond Mch. Co., Providence
Haskins Co., R. G., Chicago
Marschke Mfg. Co., Indianapolis
Norton Co., Worcester
Ransom Mfg. Co., Oshkosh
Ryerson & Son, Jos. T., Chicago
Safety Emery Wheel Co., Springfield, O.
Union Twist Drill Co., Athol
U. S. Elec Tool Co., Cincinnati
Walker Co., O. S., Worcester

Grinding Machine Centerless
Detroit Mach. Tool Co., Detroit

Grinding Machines, Chaser
Geometric Tool Co., New Haven
National Acme Co., Cleveland

Grinding Machines, Chucking
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Bryant Chuck Grind. Co., Springfield, Vt.
Heald Machine Co., Worcester
Landis Tool Co., Waynesboro
Rivett Lathe & Grinder Corp., Boston

Grinding Machines, Cutter and Reamer
Armstrong Bros. Tool Co., Chicago
Barnes, John & W. F., Rockford
Blount Co., J. G., Everett
Brown & Sharpe Mfg. Co., Providence
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Cincinnati (O) Milling Mach. Co.
Diamond Mch. Co., Providence
Gallmeyer & Livingston Co., Grand Rapids
Garvin Mach. Co., N. Y.
Gisholt Mach. Co., Madison
Heald Mach. Co., Worcester
Landis Tool Co., Waynesboro
LeBlond Mch. Tool Co., R. K., Cincinnati
Middlesex Mch. Co., Div. New Haven Sherardizing Co., New Haven
Norton Co., Worcester
Reed Prentice Co., Worcester
Safety Emery Wheel Co., Springfield, Ohio
Sellers & Co., Wm., Philadlphia
Taylor & Fenn Co., Hartford
Union Twist Drill Co., Athol
Walker Co., O. S., Worcester
Wilmarth & Morman Co., Grand Rapids

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Cleveland Armature Wks., Cleveland
Cons. Mach. Tool Corp., Rochester
Heald Mach. Co., Worcester
Landis Tool Co., Waynesboro
Norton Co., Worcester
Rivett Lathe & Grinder Corp., Boston
Sanford Mfg. Co., F. C., Bridgeport
Walker Co., O. S., Worcester
Whitney & Son, Baxter D., Winchendon

Grinding Machines, Die
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Bignall & Keeler Mch. Wks., Edwardsville
Blanchard Mach. Co., Cambridge
Diamond Mch. Co., Providence
Geometric Tool Co., New Haven
Heald Mch. Co., Worcester
Murchey Mch. & T. Co., Detroit
National Acme Co., Cleveland
National Mchy. Co., Tiffin
Walker Co., O. S., Worcester
Wilmarth & Morman Co., Grand Rapids

Grinding Machines, Disc
Besly & Co., Chas. H., Chicago
Diamond Mch. Co., Providence
Gardner Mch. Co., Beloit
Graham Mfg. Co., Providence
Rowbottom Mach. Co., Waterbury

Grinding Machines, Drill
Gallmeyer & Livingston Co., Grand Rapids
Safety Emery Wheel Co., Springfield, Ohio
Sellers & Co., Wm., Philadelphia
Wilmarth & Morman Co., Grand Rapids

Grinding Machines, Face
Abrasive Mch. T. Co., E. Providence
Blanchard Mach. Co., Cambridge
Detroit Machine Tool Co., Detroit
Diamond Mch. Co., Providence
Graham Mfg. Co., Providence

Grinding Machines, Floor
Blount Co., J. G., Everett
Brown & Sharpe Mfg. Co., Providence
Diamond Mch. Co., Providence
Forbes & Myers, Worcester
Norton Co., Worcester
Ransom Mfg. Co., Oshkosh
Safety Emery Wheel Co., Springfield, Ohio
Ryerson & Son, Jos. T., Chicago

Grinding Machines, Gage
Abrasive Mch. T. Co., E. Providence
Landis Tool Co., Waynesboro
Middlesex Mch. Co., Div. New Haven Sherardizing Co., New Haven
Rivett Lathe & Grinder Corp., Boston
Wilmarth & Morman Co., Grand Rapids

Grinding Machines, Internal
Bryant Chuck Grind Co., Springfield Vt.
Garvin Mach. Co., N. Y.
Heald Machine Co., Worcester
Hjorth Lathe & Tool Co., Boston
Landis Tool Co., Waynesboro
Middlesex Mch. Co., Div. New Haven Sherardizing Co., New Haven
Rivett Lathe & Grinder Corp., Boston
Thompson Grinder Co., Springfield, Ohio
Walker Co., O. S., Worcester
Whitney & Son, Baxter D., Winchendon

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Armstrong-Blum Mfg. Co., Chicago
Black & Decker Mfg. Co., Baltimore
Chicago Pneu. Tool Co., N. Y.
Clark Elec. Co., Jr., Jas., Louisville
Forbes & Myers, Worcester
Haskins Co., R. G., Chicago
Neil & Smith Elec. T. Co., Cincinnati
U. S. Elec. Tool Co., Cincinnati
Wisconsin Elect. Co., Racine

Grinding Machines, Radial
Landis Tool Co., Waynesboro
Rivett Lathe & Grinder Corp., Boston

Grinding Machines, Ring Wheel
Besly & Co., Chas. H., Chicago
Diamond Mch. Co., Providence
Gardner Mch. Co., Beloit
Walker Co., O. S., Worcester

Grinding Machines, Snagging
Blount Co., J. G., Everett
Diamond Mch. Co., Providence
Ransom Mfg. Co., Oshkosh
U.S. Elect. Tool Co., Cincinnati

Grinding Machines, Surface
Abrasive Mch. T. Co., E. Providence
Blanchard Mch. Co., Cambridge
Brown & Sharpe Mfg. Co., Providence
Detroit Machine Tool Co., Detroit
Diamond Mch. Co., Providence
Graham Mfg. Co., Providence
Heald Mach. Co., Worcester
Norton Co., Worcester
Pratt & Whitney Co., Hartford
Reed Prentice Co., Worcester
Rowbottom Mach. Co., Waterbury
Safety Emery Wheel Co., Springfield Ohio
Walker Co., O. S., Worcester
Wilmarth & Morman Co., Grand Rapids

Grinding Machines, Universal
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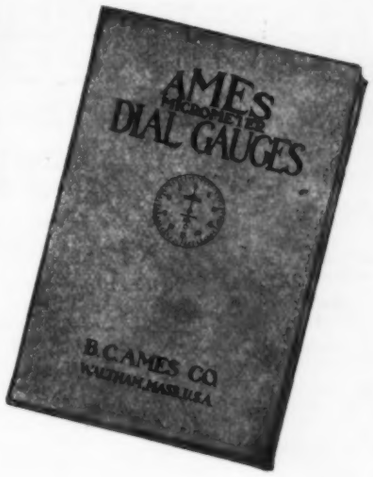

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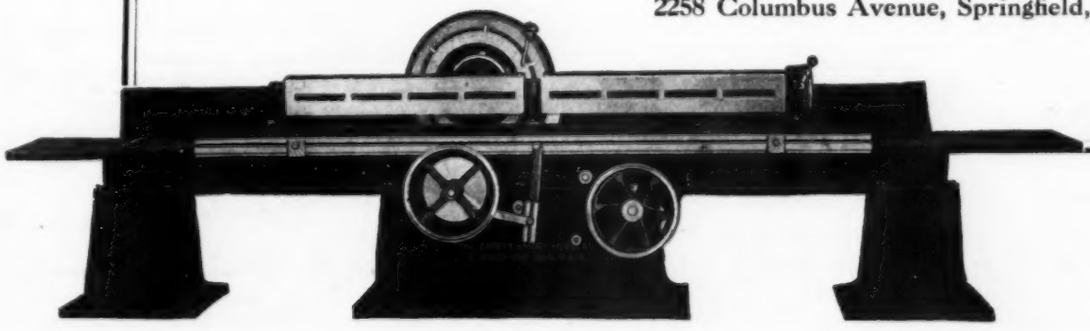

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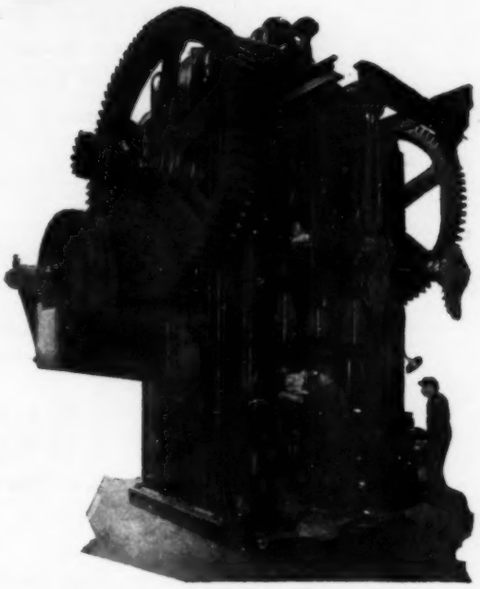

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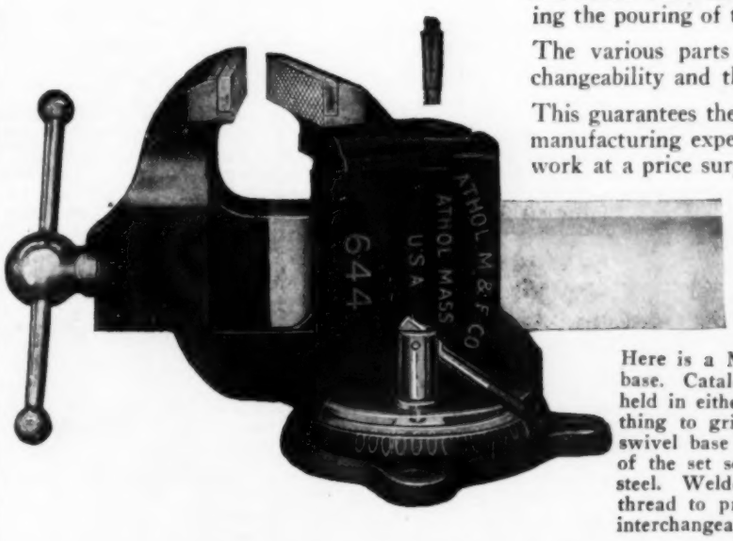

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National Acme Co., Cleveland

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Warner & Swasey Co., Cleveland

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Card Mfg. Co., S. W., Mansfield
Carpenter Tap & Die Co., J. M., Pawtucket
Morse Twist D. & M. Co., New Bedford

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Allen Mfg. Co., Hartford
Bristol Co., Waterbury
Eastern Mch. Screw Corp., New Haven
National Acme Co., Cleveland

Screws, Machine
Allen Mfg. Co., Hartford
Bristol Co., Waterbury
Eastern Mch. Screw Corp., New Haven

Seamless Steel Tubing (See Tubing, Seamless Steel)

Second-Hand Machinery (See Searchlight Section)
Bisgood, A. C., Bridgeport
Botwinik Bros., New Haven
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Brownell Mchy. Co., Dayton
Carbon Steel Co., Pittsburgh
Cincinnati Planer Co., Cincinnati
Eastern Machy. Co., Cincinnati
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Essley Mchy. Co., E. L., Chicago
Factory & Mill Supply Co., Boston
Gisholt Mach. Co., Madison
Harris Bros. Co., Chicago
Hill, Clarke & Co., Chicago.
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Hyman & Sons, Jos., Philadelphia
Ideal Mchy. Co., Plainsville
Kellogg Co., M. W., Jersey City
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Lucas & Son, Inc., J. L., Bridgeport
Machinery Dealers, Inc., New Haven
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Marshall & Huschart Machy. Co.
Matheson Co., F. F., Wilkes-Barre
Miles Mchy. Co., Saginaw
Morey & Co., N. Y.
Mueller Mch. Tool Co., Cincinnati
Myers Mach. Tool Corp.
New Jersey Machy. Exch., Newark
Niles-Bement-Pond, N. Y.
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Osborne & Sexton Mchy. Co., Columbus
Prentiss & Co., Henry, N. Y.
Simmons Mach. Tool Corp., Albany
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Van Dyck Churchill Co., N. Y. C.

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Strand & Co., N. A., Chicago

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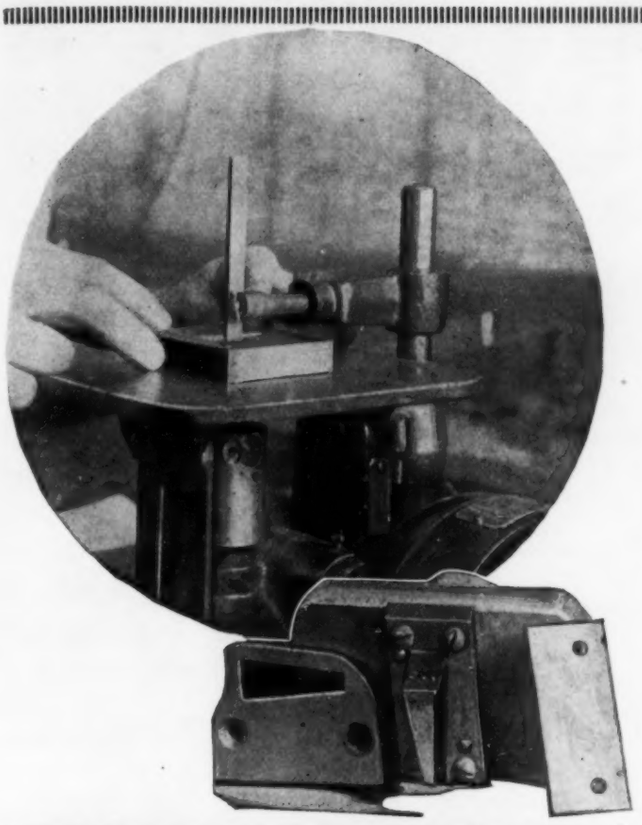
Moltrup Steel Prod. Co., Beaver Falls
Standard Gauge Steel Co., Beaver Falls
Union Drawn S. Co., Beaver Falls



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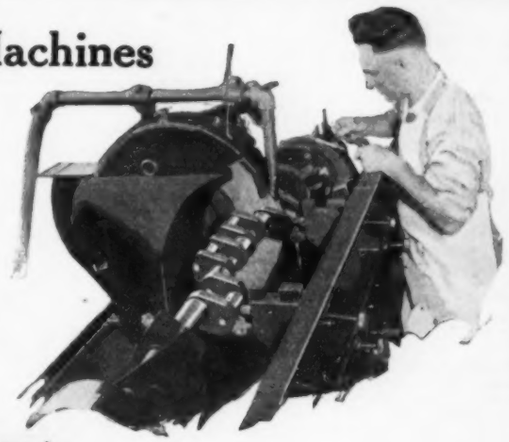

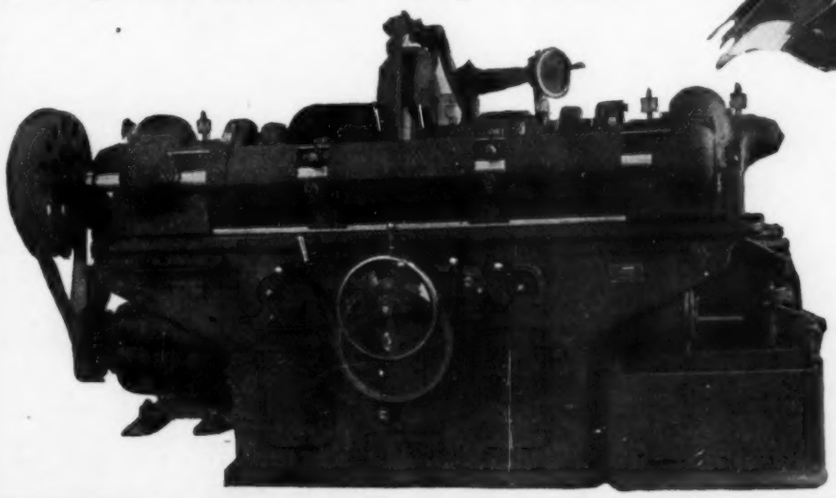

Pin diameters are ground to 2.126 in. with tolerance limits of ± 0.0005 in. Pin width is 2¾ in. with limits of 0.005 in. to 0.008 in.

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Ryerson & Son, Joseph T., Chicago
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Steel Products Eng. Co., Springfield, O.

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Shears, Hand
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Tucker, W. A. & C. F., Hartford

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Buffalo Forge Co., Buffalo
Ferracute Mach. Co., Bridgeton
Long & Allstatter Co., Hamilton
Mitts & Merrill, Saginaw
Niagara Mch. & T. Wks., Buffalo
Stoll Co., D. H., Buffalo
Toledo Mch. & Tool Co., Toledo

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Ferracute Mach. Co., Bridgeton.
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Toledo Mch. & Tool Co., Toledo

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Mfg. Equip. & Eng. Co., Framingham

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National Acme Co., Cleveland
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Pratt & Whitney, Hartford

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Grant Gear Wks., Boston.
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Morse Chain Co., Ithaca
Massachusetts Gear & T. Co., Woburn
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Union Drawn S. Co., Beaver Falls
Ward's Sons Co., Edgar T., Boston

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Hawkridge Bros. Co., Boston
Jessop & Sons, William, N. Y.

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Vulcan Crucible Steel Co., Aliquippa
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National Tool Co., Cleveland
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National Mchy. Co., Tiffin
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Hoggson & Pettis Mfg. Co., New Haven
Nestor Mfg. Co., N. Y.

Vises, Metal Workers'
Athol Machine & Fdry. Co., Athol
Reed Mfg. Co., Erie.

Vises, Milling Machine
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Cincinnati (O.) Milling Mch. Co.
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Nestor Mfg. Co., N. Y.
Whitney Mfg Co., Hartford

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Athol Machine & Fdry. Co., Athol
Butterfield & Co., Derby Line
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Lodge & Shipley Machine Tool Co.	4, 5
Long & Allstatter Co.	77
Lovejoy Tool Co.	87
Lucas Machine Tool Co.	46
Lucas & Son, Inc., J. L.	96
Luma Electric Equipment Co.	78
Lynd Farquhar	73
Machinery Dealers, Inc.	97, 98
Manchester Engr. Co.	100
Manufacturing Equip. & Eng. Co.	89
Marshall & Huschart Machinery Co.	94
Massachusetts Gear & Tool Co.	65
Master Electric Co.	79
McGraw-Hill Book Co.	64, 42
McMullen Machy. Co.	98
Meachem Gear Corp.	55
Meisel Press Mfg. Co.	54
Meisselbach Catucci Mfg. Co.	56
Mehl Machine Tool & Die Co.	101
Millers Falls Co.	48
Millersburg Reamer & Tool Co.	85
Minster Machine Co.	71
Mitts & Merrill	80
Moline Tool Co.	71
Moltrup Steel Products Co.	58
Monarch Machine Tool Co.	74
Moore & White Co.	63
Morey & Co.	95
Morris Machine Tool Co.	71
Morse Chain Co.	63
Morse Twist Drill & Machine Co.	86
Morton Mfg. Co.	87
Mueller Machine Tool Co.	100
Murchey Machine & Tool Co.	14
Myers Machine Tool Co.	100
National Acme Co.	24
National Automatic Tool Co.	63
National Blank Book Co.	102
National Grinding Co.	108
National Machinery Co.	66
National Tool Co.	86
National Twist Drill & Tool Co.	86
Neil & Smith Electric Tool Co.	78
Nelson-Blanck Mfg. Co.	70
Nestor Mfg. Co.	86
Newark Die Co.	102
Newark Gear Cutting Machine Co.	74
New Departure Mfg. Co.	19
New Jersey Machinery Ex.	96, 98
Ney Co., J. M.	83
Niagara Machine & Tool Works	76
Nicholson, W. H.	77
Niles-Bement-Pond Co.	58, 97
Noble & Westbrook	64
Norma Co. of America	65
Northern Engineering Works	63
Norton Co.	37
Nuttall, R. D.	54
Oakley Chemical Co.	88
Oilgear Co.	76
Oliver Instrument Co.	76
Oliver Machinery Co.	77
Osborne & Sexton Machy Co.	94
Pangborn Corp.	75
Pawtucket Mfg. Co.	80
Perkins Appliance Co.	56
Peerless Mach. Co.	39
Philadelphia Gear Works	54
Positions Vacant and Wanted	90
Potter & Johnston Machine Co.	20, 21
Pratt & Whitney	2nd Cover
Prentiss & Co., Henry	
Prest-O-Lite Co.	3rd Cover
Randall & Stickney	82
Ransom Mfg. Co.	79
Reed Mfg. Co.	80
Reed-Prentice Co.	32
Reliance Electric & Engineering Co.	70
Rivett Lathe & Grinder Corp.	102
Rochester Motor Corp.	102
Rockford Drilling Machine Co.	70
Rockford Tool Co.	67
Rockwood Sprinkler Co.	48
Rogers & Hubbard Co.	59
Rowbottom Machine Co.	44
Ryerson & Son, Jos. T.	47
Sachsenmaier Co., G.	75
Safety Emery Wheel Co.	109
Saunders Sons, D.	80
Savage Co., W. J.	43
Schatz Mfg. Co.	65
Schieren Co., Chas. A.	63
Searchlight Section	90
Sellers & Co., Wm.	66
Shartle Bros. Machine Co.	103
Shepard Elec. Crane & Hoist, The	62
Shore Instrument & Mfg. Co.	84
Shuster Co., F. B.	80
Sigourney Tool Co.	71
Silver Mfg. Co.	70
Simmons Machine Tool Corp.	96
Simonds Mfg. Co., Pittsburgh	56
Simplex Tool Co.	102
Simplex Wire & Cable Co.	79
S.K.F. Industries	9
Skinner Chuck Co.	82
Smith Bearings Co., L. C.	97
Smith & Mills Co.	67
Sommers & Adams Co.	87
South Bend Lathe Works	72
Springfield Machine Tool Co.	36
Standard Gauge Steel Co.	59
Standard Pressed Steel Co.	58, 101
Stark Tool Co.	74
Starrett Co., L. S. The	53
Steel Products Engineering Co.	102
Steinle Turret Machine Co.	72
Stokvis & Sons, Inc., R. S.	94
Stoll Co., D. H.	78
Strand & Co., N. A.	78
Strickland, E. M., Liquidator	100
Strom Steel Ball Co.	65
Strong, Carlisle & Hammond	60
Stuart, D. A.	88
Sturtevant Co., B. F.	78
Sullivan Machinery Co.	75
Tabor Mfg. Co.	85
Taylor & Fenn Co.	67
Taylor Instrument Co.	84
Taylor Welder Co.	61
Timken Roller Bearing Co.	28, 29
Thompson Grinder Co.	68
Thomson Electric Welder Co.	61
Thomson Spot Welder Co.	61
Toledo Machine & Tool Co.	76
Torrington Co.	81
Townsend Mfg. Co., H. P.	80
Triumph Electric Co.	102
Tucker, W. A. & C. F.	88
Underwood Corp., H. B.	64
Union Drawn Steel Co.	59
Union Mfg. Co.	84
Union Twist Drill Co.	25
United Cigarette Mach. Co., Inc.	102
Universal Boring Machine Co.	67
Universal Tobacco Machine Co.	97, 101
U. S. Ball Bearing Co.	52
U. S. Drill Head Co.	70
U. S. Electrical Tool Co.	78
U. S. Machine Tool Co.	67
Vandyck Churchill Co.	81
Veeder Mfg. Co.	85
Victor Saw Works	81
Victor Tool Co.	89
Vitrified Wheel Co.	69
Vulcan Crucible Steel Co.	58
Wade-American Tool Co.	73
Wahlstrom Tool Co.	82
Walker Inc., O. S.	82
Waltham Machine Works	76
Want Ads	90
Wappatt Gear Wks.	56
War Department	99
Ward's Sons, E. T.	59
Warner & Swasey Co.	26
Watson-Stillman Co.	75
Westcott Chuck Co.	83
Western Machine Tool Wks.	71
Westinghouse Electric & Mfg. Co.	78
Wheel Trueing Tool Co.	69
White Dental Mfg. Co., S. S.	103
White & Bagley Co.	88
Whiting Corp.	89
Whitney & Son, Baxter D.	69
Whitney Mfg. Co.	49
Whiton Machine Co., D. E.	83
Wicaco Screw & Machine Works	102
Wickes Bros.	74
Wiesman Mfg. Co.	68
Williams Tool Corp.	69
Wilmarth & Morman Co.	68